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OF THE

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DEPUTY INSPECTOR OF MINES

FOR THE

SIX MONTHS

ENDING

November 30th, 1889

BY

G. C. SWALLOW, INSPECTOR,

AND

J. B. TREVARTHEN, DEPUTY INSPECTOR.

1890
JOURNAL PUBLISHING CO.
HELENA, MONTANA.

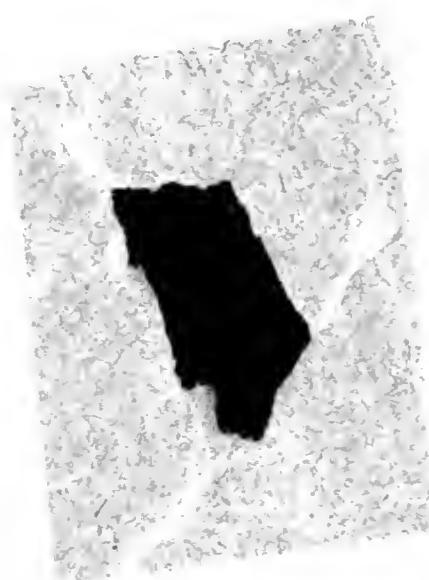
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His Excellency,

JOSEPH K. TOOLE,

Governor of Montana:

I have the honor herewith to transmit my report as Inspector of Mines for Montana.

Entering upon the duties of my office in June last, it was deemed advisable to examine first those districts least known, and which most needed capital and railroads to assist in developing and making the workings of their mines profitable. I have had time to examine the mines in the eastern and southern portions of the State, in Park, Meagher, Fergus and Cascade counties. These and the coal mines of Custer, Yellowstone, Choteau, and Lewis and Clarke counties are included in this report. I have also examined many mines in other counties of the state; but it is deemed best not to report on these mines until the pioneer camps and the best known mining districts in Beaverhead, Madison, Silver Bow, Deer Lodge, Lewis and Clarke, Missoula, Jefferson and Gallatin counties have been examined, save to give a general view of mining in each county.

When Mr. J. B. Trevarthen was appointed Deputy Inspector of Mines and in consequence of his intimate knowledge of the mines of Butte and the neighboring camps, it was arranged that he should examine the mines of that region, and attend to such accidents as might occur, so far as the appropriation for his services could pay his per diem. I have found Mr. Trevarthen a willing, earnest, and efficient co-worker in the pleasant though often perplexing and arduous duties assigned us. I also transmit Mr. Trevarthen's report of his labors and the accidents which have occurred.

I must also mention with gratitude the willing aid so many of our fellow citizens have rendered me in the prosecution of my examinations and in data for my report. As a list of those who have thus aided, would be too long for publication, and as a selection of a few would be invidious and unjust, I hope all of them will find their reward in my report, which they assisted in making.

Hoping that our reports contain such information respecting the number, value, sanitary and safe condition of our mines as shall meet your approbation, I remain

Your Obedient Servant,

G. C. SWALLOW,

Inspector of Mines.

Helena, Dec. 1st, 1889.

MINES OF MONTANA.

More than twelve thousand mining claims have been located in Montana under the mining laws of the United States; and more than one-half of these claims have been so prospected as to determine something of the position and richness of "pay gravel," if they be placer claims, or of the character and richness of the ore, if they be quartz claims. Probably one-quarter of that number have been so developed as to show the kind and size and general characters of the veins and thus enable one to form some safe opinion of the quantity and richness of the ore and what machinery is best adapted to work it; and enough work has been done on these to show they are bright prospects and to give them a market value. There are fully two thousand mines so well opened and show ore enough to place them on a paying basis by erecting mills or furnaces for reducing the ores, or by shipping them to works already erected. But comparatively few of this great number have really been put on such paying basis. And yet these few are wonderfully productive. In fact, we have, with very few exceptions, merely scratched the surfaces of our thousand mines, and yet they have for several years yielded so much gold, silver, copper and lead as to place Montana at the head of the mining States of this Great Mining Republic. And there are other thousands of bright prospects, which look just as promising as the Granite, the Anaconda, the Spotted Horse and the Drum Lummon did at the same stage of development.

What these bright prospects need to make many of them real bonanzas, is capital to work them and cheap transportation for fuel, ores and bullion. Fortunately, Montana has within her own borders all the mineral fuel these mines will need for the next thousand years, even though their demands be increased, as they will be, ten fold above what they are at present. Gallatin county, Park county, Custer county, Yellowstone county, Fergus county, Cascade county and Choteau county have what are practically inexhaustible supplies of mineral coal.

ACCIDENTS IN OUR MINES.

The accidents in the mines of Montana for the last six months have been very few when compared with the many thousand workmen who are employed in them. These accidents have not been more numerous in proportion to the number of miners than are the accidents among railroad men, and lumbermen, and scarcely more than among teamsters and mechanics generally.

There have been four principal causes of the accidents which have occurred.

1st.—The premature, the tardy, and the accidental explosions in blasting.

2d.—Exposure to impure air.

3d.—Being caught between the cage and the timbers of the shaft.

4th.—Being struck by caves and falling rocks.

From a long personal experience in the use of black powder and giant powder and dynamite in blasting, I say without fear of contradiction by any competent authority on blasting, that all accidents of this kind are due to defective material, to a want of skill in using the materials, or to pure carelessness. There is no need of discussing the use of black powder, as that is no longer profitable in mining.

But cartridges of dynamite or giant powder, caps and fuse are now so accurately made, that the skilful workman can very nearly tell what effect any cartridge will produce; and can know how long any given length of fuse will burn; and nine hundred and ninety-nine caps in every thousand will explode the cartridge. If, therefore, the best cartridges, caps and fuse be used and they be kept in safe places where they can receive no injury, the skilful workmen need have no fear of accidents or want of proper results. If the hole be drilled of proper size and shape so the cartridge will slip in without serious abrasion or concussion, if the cap be well fitted to the fuse and both properly attached to the cartridge, there will be no premature nor tardy explosions, and no failures. So that all the accidents of this kind are due to bad material, want of skill in their use or pure carelessness.

Exposure to impure air is seldom necessary in the mines of Montana. The means and apparatus for ventilating mines are so perfect that all ordinary danger from impure air can and

should be avoided. The works in our coal mines are so near the surface that every adit and chamber can be perfectly ventilated at small expense by air shafts to the surface above.

In some instances, as at the late fire in the Anaconda mine, brave, generous men will expose themselves to bad air to save the lives of their fellows, and sometimes to save property. There is no feasible specific remedy for such self sacrifices. Perhaps none is desirable. Persons, who have thus devoted energy, health, and even life itself to such noble deeds, have made the best use of them known to man.

Several men have lost their lives in a horrible manner by being caught between the cage and the cross-timbers of the shaft. Such accidents appear to be inevitable as long as men will carelessly expose themselves and their fellow workmen, and as long as men will sometimes lose their heads, become dizzy, or faint. When a cage is crowded with men, the least movement or jostling is liable to prove instantly fatal to some one of the number by the rapid and irresistible motion of the cage itself.

It would seem as if any ingenious mechanic could make a cage safe with little expense and without detriment to its rapid use for other purposes than carrying men,

I will suggest one method which will make the cage absolutely safe from such accidents with very little expense, and which will cause no delay in transporting the men and no detriment to its use for other purposes than carrying workmen in and out of the mine.

Let a wire net or screen wide enough to close one side of the cage and as high as a man's head, be coiled on a gas pipe fastened near the side and under the bottom of the cage, one on each side, to be drawn up as curtains are drawn down, and fastened to bars above, so that no one in the cage could possibly put out even a foot or hand so as to be caught by the timbers of the shaft. This screen and gas pipe on which it is coiled, could be so attached to automatic springs, that it would be coiled away the instant the cage reached the top or bottom or any desired station on the shaft. The cylinder or gas pipe on which the wire screen is rolled, could be placed above and the screen be drawn down like a curtain instead of up, should it appear more desirable.

Such an arrangement would render any such accident and terrible mutilation impossible, would cost very little, would not in the least unfit the cage for any other use, and would cause no appreciable delay to the men in entering or leaving the cage.

I know of no reasonable objection to such a safeguard to human life. Any good smith could make and fit it to the cage.

Accidents by caves and falling rocks.—While man knows so little about the strength of timbers and the size and weight of loosened masses of rock, of which he can see a small portion only, some accidents from caves and falling rocks appear to be unavoidable, whatever be the care taken to prevent them. Accidents of this kind are very rare in our mines, and might be made more so by proper precautions in prospecting and developing and working them.

Every manager, every foreman and every miner should remember always, and under all circumstances, that safety to life and limb is the first great conservative principle of our human nature. All that a man hath will he give for his life; and health and sound members are necessary to make even life desirable and happy.

Our mines are as safe as any I have ever examined; but they can be made safer even than they are now, and it is the highest duty and best interest of all to have it done; for the best workmen seek the mines which are best managed and made safest.

No good miner would long work in a mine and go up and down a shaft four times a day where the careless or necessary movement of a companion would endanger his life and limbs, when he could work in a mine equally as well managed, where all such accidents were made impossible.

Fires in mines.—It may not be amiss to make a single suggestion as to the mode of extinguishing fires in mines. One of the most effectual methods is by the use of carbonic acid gas. This gas is so much heavier than air that it can be poured from one vessel into another as easily as water, and will flow into a mine, drive out the air, and extinguish the fire as effectually as water and almost as quick; and it will do no injury to the mine or any of the works in it, as water often does. And besides, the mine can be easily freed from this gas by the ordinary ventilating apparatus.

This gas however, should not be used in mines, or parts of mines where men are, for it will drown a man as quick as water would.

The materials and apparatus for making this gas are cheap, nearly always at hand in a mining camp, and can be easily and quickly put in operation. An old whisky barrel or water tank, with hose attached, will do for apparatus when none better is at hand. Fill the barrel or tank with chips of limestone or marble,

or bicarbonate of soda, and add the acid, diluted with four or five parts of water, gradually as needed to keep up the generation of the gas.

The gas thus made may be conducted into the mine and allowed to fill it as water would; or it may be conducted to any part of the mine by hose or pipes. If the tank or barrel be strong and tight the pressure of the accumulating gas, will drive it through hose or pipes with great force.

By this method the fire may be extinguished in a few hours or in a few days, at most. The cost is trifling, and no injury is done the mine.

THE MINES OF EASTERN MONTANA.

That spur of the Rocky Mountains which crosses the Missouri river at the Gate of the Mountains north of Helena, so divides, that one branch extends south through Meagher county into Gallatin, forming the Belt range, the Crazy and the Castle Mountains, and another branch spreads out eastward through Meagher, Cascade and Fergus counties, forming the Little Belt range, the Big Snowy, the Judith and the Highwood Mountains.

While these eastern developments of the Rocky Mountains which lie between the Missouri and the Yellowstone rivers, constitute but a small portion of those mountains in Montana, still they intersect and give character to a beautiful and favored region as large as some of our sister states. Though this portion of the state has been but little considered in summing up the metallic wealth of Montana, still hundreds, yea thousands of metallic veins have been discovered in these mountains and many extensive coal beds have been opened in nearly all the intervening valleys and the surrounding plains.

If one will take a few months and examine all the mines, placer and quartz, in the Belt range from Cascade on the north to Livingston on the south, all the rich veins of gold and silver and lead and iron and manganese at Castle, the copper veins at Copperopolis, the Spotted Horse and other mines and numerous prospects in and upon the Judith mountains and around Maiden, the rich mines on Dry Wolf, on Running Wolf and at Yogo, the rich and wonderful veins of silver and gold and lead and iron at Barker and in the surrounding mountains, and the numerous lodes of precious ores which intersect the lofty mountains about Neihart, after such an examination, without taking in many other minor localities, he will certainly be very strongly impressed with the great mineral wealth of this most favored region. If he would satisfy himself that nature has made ample provisions for working and reducing these vast deposits of ores, let him examine the coal beds at Sand Coulee, those on Smith River, Willow Creek, and south to Sixteen Mile Creek, Bozeman and Cokedale, thence east to Bull Mountain, and north to Robert's and Careless creeks and to the beds around Judith and Moccasin

mountains, on Sage and Wolf creeks and other tributaries of the Judith river, and those on Otter and Belt creeks. These numerous and extensive coal fields now but scarcely opened, cannot fail to convince him there is, in and around these mining centers of Eastern Montana, a supply of good coal sufficient for all mining purposes for this and all future generations.

If one has any fears about supplies of timber and water for this extensive mining region, an examination of the mountains above named will show they are covered with timber suitable for mining purposes; and that they are full of springs and streams which supply all the waters of Belt and Arrow creeks and Smith, Judith and Musselshell rivers and many small tributaries of the Missouri and Yellowstone.

The agricultural capacity of this country is clearly shown by the numerous herds and flocks grown and fattened upon its native grasses alone, and by the productive farms on Smith, Belt and Judith rivers and their many tributaries.

It is a land rich in mines, rich in trees and grasses, cooled in summer by snow-capped mountains and ice-cold fountains and streams, and warmed in winter by chinook winds from the warm waters of the Pacific.

The buffalo, the antelope, the deer, the elk, the bear, and above all the Indian were slow to give up so fair a country. But those who came to spy out the land soon saw its advantages, and the arts of civilization, the pick and the shovel, the plow and the reaper, the herd and the flock, and especially the rifle and the revolver, soon drove out the savage beasts and still more savage Indians.

It is perhaps too much to expect that nature has coked some portion of our many coal beds and thus saved us that expensive operation in fitting our caking coals for the furnace. But it has been done in other mountain regions; why not in this?

It is well known that anthracite is but a natural coke made from the beds of caking coal by the heat developed in forming mountains and under the great pressure of over-lying rocks, which condensed it into a solid structure.

For this reason all prospectors and surveyors and hunters may make valuable discoveries by having their eyes open for coal in our mountains, especially where coal beds exist in the adjacent valleys and foothills.

A very large proportion of the mines in the camps above named, have smelting ores carrying so much lead that cheap transportation becomes an essential element in working them

successfully. A few mines, however, like the Spotted Horse, have milling ores so rich, and the bullion is of such a high grade, that transportation is but a small per cent of the cost of working. Such mines are worked with profit at a distance from railroads.

The miners in these camps have confidence in their mines, and are waiting with patience for the whistle of the locomotive to make them rich.

THE MINES OF MAIDEN.

Almost every mining camp in Montana has its great leading mine, which attracts the attention of the outside world. Marysville has its Drum Lummon, Castle its Cumberland, Pardee its Iron Mountain, Phillipsburg its Granite Mountain, and Maiden has its Spotted Horse.

In years past the Maginnis was the leading mine of Maiden, but the Spotted Horse, after its ups and downs, incident to the effects of rich and poor streaks found in all mines, has been for many months supplying two mills with ores rich enough to enable them to turn out such results in bullion as to give this mine a place in the first rank of the world's bonanzas. But the Spotted Horse must look well to its laurels; for there are other mines at Maiden which will tread close upon its heels when capital works them.

But in some respects Maiden is one of the most remarkable mining camps in the world. Maiden is in the midst of, and claims for its mineral kingdom, all the peaks and ridges and foothills of the Judith mountains; for all of them are literally covered with vast quantities of good float and must be intersected with numerous veins of rich ores. Hundreds and hundreds of mining claims have already been opened in these mountains, and new discoveries are the order of the day. Many of these discoveries have been so developed as to show they contain vast quantities of good ores.

The Judith mountains must have been, are now and must continue to be, the paradise of prospectors. In many places I saw large bodies of iron ores so charged with gold as to make them most desirable fluxing ores. And above all, the valleys and gulches and mountain slopes were strewn with fragments, great and small, rich in gold and silver. So abundant is the float from the veins of these mountains that it will be gathered up with great profit at no distant day.

So numerous and varied were the float ores as to bewilder the prospector in tracing them up to the leads from which they came. But hundreds of those leads have been discovered and

opened and represented from year to year to hold them till such time as a railroad will give cheap transportation and make their ores valuable.

This mining region is very large, covering the entire group known as the Judith mountains for miles in every direction from Maiden to the Occident, six miles west, to Deer Creek north, to Cone Butte and east to Fort Maginnis. In all this vast area, in every valley, on every mountain side, from base to summit, and every foothill, we find shaft and tunnel in upon veins of ore which everywhere intersect these mountains.

There are three classes of veins in these mountains, contact veins between the limestone and porphyry or igneous rocks, crevice veins cutting the highest ridges and the lowest valleys, and blanket veins lying between the rock strata and on the surface of the strata.

So far the contact veins have been most developed and have shown vast quantities of ores in deposits somewhat irregular, as might be expected. The crevice veins have not appeared so large and have not been so much worked. Of the blanket veins but little is as yet known; those seen have not been much developed.

The ores of this mining region are very variable in both the characters and quantities of the metals they carry. We find regular quartz carrying gold and silver, good milling ores. We also find soft material like mud, rich in gold, sometimes silver. Galena and carbonate of lead, copper pyrites and carbonates of copper, carrying silver and gold are abundant. There are also various ores of iron and manganese rich in the precious metals. These lead, iron and manganese ores will be valuable as fluxing ores for those more refractory.

All the mines and bright prospects in and around Maiden in the Judith mountains would make a very long list as they appear in my notes; but it may be well to give a few in each locality.

At Maiden are the Spotted Horse, Maginnis, Alpine, Kentucky, Key West, Montana, P K, Meteor, Florence, Pilgrim, Black Hawk, Collar, Bamboo Chief, Silver Chain, Oro Cache, Hailstorm, Whale, Golden Arrow, Edward Cooke.

At Cave Butte, six miles northeast of Maiden, are Cave, G and M lodes, Clear Grit, Bertha, Premium, Chicago, Old Chicago, Golden Eagle, Last Chance, Bull-of-the-Woods, Ste. Olive, Iron Clad, Lead Trust, Independent, Plymouth and many others, nearly all on contact veins between porphyry and slate and limestone and in crevice veins in porphyry and limestone and slate.

Near Fort Maginnis are the St. Paul, Crescent, Judith and others.

On Red Mountain we saw the Northern Pacific, Silver Reef and Tom Payne.

On Sheep Mountain is the Big Four.

The Occident is six miles west southwest of Maiden.

On Deer Creek are the Iron Duke, Elk Horn, and Big Horn. There are a million feet of good pine lumber and a good stream of water on these claims.

Silver Wing is on Crystal Mountain. Large bodies of iron ore, limonite, were observed in Arnell Gulch and in other localities.

Limestone is found in all parts of this region; so there will be no lack of fluxes and fluxing ores for the furnaces which shall pour out the precious bullion contained in these hundred mines.

Placers have been discovered and worked with greater or less success in various gulches of the Judith mountains.

Water, an absolute necessity in all mining operations, gushes out in fountains on every mountain side and flows in never-failing streams down every ravine and valley to supply the waters of Judith river, and Dog, Deer, Arnels, Box Elder and McDonald creeks. These fountains and streams were full and flowing in the summer and fall of 1889, the dryest season ever known to the oldest pioneers in Montana.

Forests of pine, fir and spruce cover all these mountains and will furnish timber in abundance for all mining purposes, and fuel where wood is better than coal.

But nature has laid up in mineral coal, stores of fuel all around Maiden far in excess of that in all the forests of the state, for the supply of all the future wants for domestic and mining purposes.

There are two ten-stamp mills at Maiden now running on the ores of the Spotted Horse. These mills have concentrators for condensing and saving the rich tailings for the smelter. These concentrates make large additions, as I am told, to the bullion produced by the mills.

The Spotted Horse was the only mine at Maiden working over four men when I examined that camp. In the recent workings of that mine, the work was well done and made perfectly safe. The old works had been abandoned and were not examined.

A railroad is all that Maiden needs to make it one of the most extensive and productive mining camps in the state.

THE MINES OF CASTLE.

The first discovery of mines in Castle Mountains was made in 1885. They at once attracted the attention of the mining world and have ever since held a prominent position in public estimation. A great many discoveries have been made and an unusual amount of energy has been displayed in developing quite a number of these prospects into mines. This was to be expected where rich ores in such abundance moved the muscles wielding the pick and shovel.

Castle is a mining camp built in a beautiful sheltered valley near the southeast base of Castle Mountain. This mountain received its name from the castellated rocks which form the very attractive features of its crest and peaks. The principal mines are on a series of rounded mountain spurs from one to six miles from the town. The mountains are limestones, porphyries, granites and various eruptive rocks.

The ores occur in contact veins, crevice veins, blanket veins and veins of segregation. Many of the best mines are opened along the line of contact between the limestone and porphyry.

The ores are oxides and sulphurets of iron carrying gold and silver, carbonates and oxides and sulphurets of copper and lead containing gold and silver, oxide of manganese containing gold and silver, and sulphurets and other ores of silver. These ores vary in richness all the way from one or two dollars up to ten or twelve thousand dollars per ton.

A very large number of the mines of Castle have a cap of iron ores, known to old English miners as *gossan*, and though these caps are not rich in gold and silver and copper, they have been in all ages and in all great mining countries esteemed a good indication of rich mines. This opinion was so strong and prevalent among the miners of Europe at a very early day in the history of mining, that it found expression in several languages; as shown by the "*gossan hood*" of Cornwall, "*chapeau de fer*" of France," and the "*eisernen hut*" of Germany. It even became a proverb in the very early ages of mining, as is shown by the following, well known to German miners:

"Er ist nie nicht gang so gut
Der tragt nicht einen eisernen hut."

No mine is deemed so good,
As one that has an iron hood.

This opinion has been so universal as to give it all the force of the old legend—

Vox populi, Vox Dei.

Though the iron and manganese ores which form these caps, are not, as a rule, very rich in the precious metals, they carry enough to make them very valuable fluxes to use with more refractory and richer ores.

There is a furnace at Castle, which has smelted the ores from several of the Castle mines with what would seem to be good results. During the last fall it run 2,000 tons from the Cumberland, which yielded bullion worth some \$90,000, and only a profit of \$27 per ton on the ore delivered at the furnace. The Connellsburg coke used cost \$25 per ton, and the charcoal 15 cents per bushel. The bullion contains so large a per cent of lead that the freight and refining make a large reduction on what would otherwise be net profits. The refining costs \$16 per ton, and the freight to Aurora, Illinois, costs \$22 per ton; and the freight on coke by rail to Livingston and by wagon to Castle, costs about the same. Thus the freight bills alone exhaust the value of good ores. Hence, none but the richest ores can now be worked at Castle.

These figures show that a railroad to Castle would save in working the ores of that district from \$15 to \$20 per ton. This saving would enable the miners to take out ores at a fair profit, which yield no profit under the present charges for freight on ores, fuel and bullion.

Hence, a railroad to Castle would give a commercial value to ores which now have no sale, and would largely increase the value of the better ores. In fact, a railroad to Castle would increase the value of all the ores in that district more than \$15 per ton, and this on a million tons which they could easily produce, would put \$15,000,000 in the pockets of the Castle miners. And besides, the railroad would so reduce the cost of mining that the expense of taking out the ores would be much less than now.

Among the mines which were in active operation when I examined the district, were the Cumberland, Yellowstone, Felix, Crescent, California and Judge, and many others. The work on these mines had been well done and the mines were in as safe and healthful a condition as such mines could well be made. Work had been suspended for the time on the Great Eastern, the Legal Tender, Hidden Treasure, Black Hawk, Alice, Iron Chief, Powderly, Hampden, Jumbo and many others.

About nine hundred promising discoveries have been located in the district, and many of them have been so far developed as to prove them valuable mines. Large amounts of ores have been shipped to the Helena and other reduction works.

The whole region is well timbered with fir and pine, suitable for all mining and domestic uses; there is an ample supply of good water for all the wants of a large mining population.

What Castle most needs is a railroad. The whistle of the locomotive would inspire new life and fill a hundred mines with hopeful workers, whose nerve and muscle had received new activity and power; and the whistle of new furnaces and mills would soon startle the denizens of these beautiful mountains.

WILLOW CREEK MINES

Are on Willow Creek, about half way between White Sulphur Springs and Castle. A number of discoveries have been made at this locality. These have been more or less developed with varied success. But enough has been done to give strong hopes of a rich camp. Of the mines opened, the Grasshopper is deemed the most promising.

MINES AT COPPEROPOLIS.

Copperopolis is situated on a low ridge of metamorphosed argillaceous shales or slates between the Castle and Little Belt mountains. It took its name from a series of copper veins discovered and partially opened early in the sixties, when the Red Man claimed the buffalo, antelope, deer, elk and bear in the beautiful hunting grounds on the Yellowstone, the Musselshell and the Judith, and the hunting grounds themselves as most like those celestial hunting grounds where all good Indians go. Then the Red Brother often made it hot for the prospector and sometimes left him far from home, but relieved of all care of his horses, grub and blankets—without “transportation, bed or board.”

Several true crevice veins of copper ores have been opened along this ridge of slates for a distance of four or five miles. The principal ores are carbonates and sulphurets of copper, grey copper and native copper. These ores contain from 20 per cent to 50 per cent of copper and from \$8 to \$15 per ton of gold and silver, as shown by assays and by the yield of ores shipped to and smelted at Butte. The prospects at Copperopolis are very encouraging; the ore is rich and in true crevice veins of good

size; but no one can tell how extensive and rich they will prove until they have been more thoroughly developed. The slates of this district are favorable for copper veins.

BELT MOUNTAIN MINES.

While from the earliest days of Montana mining, the streams and gulches and bars of the Belt mountains have been noted for furnishing many productive placer mines, there have been but few discoveries of the quartz veins from which the glaciers ground out and deposited the vast quantities of gold taken from these placers.

Of the numerous placers worked in the Belt mountains every one has heard of Confederate gulch, and Montana bar, near Diamond City; White's, Avalanche, Oregon, Magpie and Cave gulches, and New York gulch on Trout creek, and French, Colorado, American, McCune's and Ming's bars opening out on the Missouri side; and Benton, Cement and Thompson gulches on the Smith river sides. Many of these placers are still worked with good results and companies are often formed to furnish more efficient machinery for clearing out these vast deposits of golden sands and gravels which have been but imperfectly worked by the primitive methods used in our early mining.

A company has just been organized to work the placers of Eldorado Bar with the expectation of obtaining in addition to the gold, the still more valuable precious stones found there in such quantities, sapphires, oriental rubies, oriental topazes and oriental emeralds. These placers are still yielding considerable quantities of gold every year.

TROUT CREEK QUARTZ MINES.

It is a remarkable fact that but few of the quartz veins which furnished these extensive deposits of placer gold in the Belt mountains have as yet been discovered and worked, but at an early day a quartz mill was erected to work some quartz veins discovered in the red shales of Trout creek; but with what success I have not learned. A new ten stamp mill is now doing good work at Trout Creek.

CONFEDERATE QUARTZ MINES.

Several quartz veins were discovered at an early day in Confederate gulch, and a mill was erected there to work the ores; but the want of success was due to the bad management rather than to the character of the ores.

Hitherto the great success of placer mining in Confederate and New York gulches and on Montana and Eldorado bars has so absorbed the attention of the miners in those regions, that but little attention has been bestowed upon the quartz veins already discovered at these localities. It is, however, reasonable to expect that future explorations and developments will bring to light many of the veins from which the glaciers ground out the large quantities of gold washed from these famous placers during the last twenty-five years.

The Belt range from the Gate of the mountains south to Diamond City, have been most distinguished for the placer mines named above; but south of Diamond City, there has been very little placer mining, and several important groups of quartz mines have been located and somewhat developed, as at Birch creek, in Murray district, and in the Russell district, east of Toston.

BIRCH CREEK MINES.

A number of quartz veins have been discovered and worked on Birch creek, a tributary of Smith river. Of all the mines in this group the Bourbon has attracted the most attention. The ores have been shipped out and worked with the most flattering results.

MINES OF MURRAY DISTRICT.

The Murray District is in the Belt mountains, south of the road from Townsend to White Sulphur Springs. The mines show more copper ores than any other veins in the Belt range.

It should be observed that the Murray District is on the direct line from Copperopolis to the Green Copper mines six miles north of Radersburg and at the base of Crow mountains and the copper mines at Butte. The rocks at the Bigger District in the Little Belt mountains, at Copperopolis, in the Belt mountains and at the Green Copper mines at the base of Crow mountains, all on the line from Copperopolis to Butte, are the same argillaceous variegated shales, and all the mines and prospects on this line carry rich copper ores. These facts would seem to indicate a copper belt from Butte through Crow mountains, across the Belt mountains, through Copperopolis to the Little Belt range. It is therefore more than probable that the mines in this copper belt may prove large and rich in copper, silver and gold. In view of the fact that the mines at Copperopolis and Crow mountains look as well now as some of the best copper mines did at Butte at the same stage of development, we may predict good things for the future of this copper belt.

MINES OF RUSSELL DISTRICT.

Several crevice veins have been opened in the variegated argillaceous shales in the foot-hills east of Toston. Among the claims located and represented by a large amount of work, are the Grant, O. K., Gray Eagle, Poker Stake, War Eagle and Blue Cloud. The ores are oxides and sulphurets of iron carrying gold, sulphurets and carbonates of copper and lead containing silver and gold. These prospects are in strong vertical crevice veins which cut across the shales in direct lines and for long distances through hills and valleys.

Whether more work would develop these good looking prospects into rich and productive mines no one can tell from present indications. But the fact that these veins are in or near the copper belt above named, that they are in the same shales as the mines in that belt, and that they contain the same ores, should give more hopes of finding good mines in this district. Timber and water are scarce in the immediate neighborhood of these mines.

Such are the mines and prospects of mines in the Belt mountains. If its quartz veins shall prove as productive as its placer deposits have, the Belt range will maintain its fair fame for productive mining for long years to come.

MINES OF LITTLE BELT MOUNTAINS.

Unlike the Belt Mountains, the Little Belt range is more noted for its quartz mines than for its placers. While a few placers only, have been worked and these with moderate success, some of the quartz discoveries are so well known as to enlist the investment of capitalists and attract the attention of railroads. One road is now laying its rails towards Barker and Neihart, to aid in the development and share the profits of the rich and extensive mines in those districts. The principal mines as yet discovered in the Little Belt mountains are at Neihart, on Dry Wolf, on Running Wolf, at Yogo, in the Bigger District, at Williams' camp and at Barker.

The Little Belt mountains are well timbered with pine, red fir and spruce. They furnish the waters of the eastern tributaries of Smith River, the northwestern tributaries of the Musselshell, the western tributaries of the Judith and the head streams of Arrow River and Belt Creek.

THE BIGGER MINES.

The Bigger District is in the foothills at the southwest base of the Little Belt Mountains, on the North Fork of Smith River, and about ten miles from Copperopolis. Several claims have been opened here on good sized crevice veins in argillaceous shales, similar to those at Copperopolis. The quartz is stained with iron and manganese carrying gold. It also contains sulphurets and carbonates of lead and copper carrying gold and silver. Some of the ore yields as much as \$20 and \$30 in silver and gold, and thirty to forty per cent of copper.

Very little prospecting has been done in this district, and the few discoveries made have been but little worked. There is an abundance of timber and a scant supply of water near the mines.

YOGO MINES.

Mines have been discovered and opened over a large area at and around Yogo. These mines are on Yogo Creek, Skunk Gulch, Elk Gulch, Lead Gulch and Black-Tail Gulch, and in the mountains for five or six miles around Yogo.

Placer mines have been worked in Yogo Gulch for six miles below and as far above the camp; there were good placer mines in Skunk and other gulches around Yago. Some of these placers are still worked with profit.

A great many quartz discoveries have been located in this district, and some of them have been so developed as to prove good mines. Gold Belt, Golden Slipper, Allen, Quaker City and My Choice are on Skunk Gulch; Blue Dick on Elk Gulch; Golden Treasure between Skunk Gulch and Elk Gulch; and T. C. Power and other mines show considerable bodies of good ore on the mountains above Yogo.

Nearly all the mines in this district have iron caps carrying free gold, some contain sulphurets and carbonates of lead and have native copper and azurite and malachite and copper pyrites carrying gold and silver; and some show sulphurets of Silver. A very large part of the ore developed in this camp is free-milling gold, and is easily worked and amalgamated in common quartz mills and arastras. But the ores deeper in the mines are sulphurets instead of oxide of iron.

Mr. C. W. Gardiner has a small mill on Skunk Gulch. This mill consists of a Blake crusher, a Hunter oscillator and a Frue-Vanner concentrator. The mill is working from six to

fifteen tons of ore from the Gold Belt per day. The ore yields about \$15 per ton. Two men take out the ore and run it into the mill, and two run the mill, so the mining and milling are economically conducted.

Mr. Elias Shelby has an excellent arastrā at Yogo, running on the ore from the T. C. Power mine. The arastrā has two tubs which are run by an overshot water wheel. This arastrā ought to do good work, as the ore is a brown oxide of iron, containing from \$10 to \$40 per ton in free gold.

The Yogo District has an abundance of good timber and water for all domestic and mining purposes. There is an ample supply of mineral coal on Sage Creek in the adjacent valley.

MINES ON RUNNING WOLF.

I started up Running Wolf Creek to examine the mines in Running Wolf District, but on my way learned that all the miners had left the camp the day before, and as I could not examine the mines alone, the Hon. Paris Gibson has kindly furnished the following excellent description of them, by Mr. H. H. Chandler, who had long experience in the mines of Little Belt Mountains.

Dr. G. C. Swallow, Helena, Montana:

DEAR SIR—In reply to your letter of 12th inst. requesting information concerning the mines of Running Wolf District, I would say: The most promising mines of the district are the Mortson and Woodhurst, Red Oxide, Sir Walter Scott, Last Chance, Mountain Side, Eureka, Ada and Castle. The first named mine (the Mortson and Woodhurst) is a contact vein between porphyry and limestone. Some 500 tons of fine carbonate ore have been extracted from this mine, averaging by working test of thirty tons made at the Montana Smelting Company's works at this place, 30 ounces of silver per ton and 65 per cent. lead. The mine is comparatively undeveloped, yet for a distance of 300 feet along the course of the lead and as far as worked, it shows a continuous vein, varying from two to six or seven feet in width of a very superior quality of smelting ore, principally lead carbonates, and entirely free from zinc and other refractory metals. Further developments will undoubtedly prove this to be one of the most extensive silver-lead deposits in Montana.

The Red Oxide, adjoining the Mortson and Woodhurst on the south, shows an immense outcrop of iron and copper ore assaying 10 to 20 ounces in silver. A shaft 50 feet deep has been sunk on the lead, all in ore of the character described.

The Sir Walter Scctt is located about one and a half miles north of the Mortson and Woodhurst, near the summit of the mountains, in a lime and porphyry contact. The ore is of an entirely different character from that mentioned above, being a sulphuret and chloride of silver, and carrying no lead, or what is termed a free milling ore, averaging according to mill tests 60 to 70 ounces of silver per ton. Very beautiful specimens are obtained from this mine, assaying upwards of 1000 ounces of silver per ton. At several points along the course of the vein shafts have been sunk, 25 to 30 feet deep, and drifts run for 60 feet, disclosing a vein of excellent milling ore from two to five feet wide. Owing to the location of the mine (near the top of the mountain) being somewhat difficult of access, and the heretofore isolated position of the district, but little more than the annual representation work required by the mining laws has been done. But with railroad communication and better facilities for working, which the district soon will have, this (as well as many other mines in this district) will be vigorously worked; and, judging from present indications, will prove one of the best paying mines in the camp.

The Ada, Mountain Side, and Last Chance locations, show fine bodies of fair grade smelting ore.

Taken altogether, the Running Wolf District, with its abundant supply of fuel and water, its large deposits of free ore and its bright prospects of immediate railroad communications, will, in the not distant future, occupy a position as a bullion producer second to no other mining district in the rich and extensive mineral zone of the Belt Mountain Range.

Respectfully,

H. H. CHANDLER.

Great Falls, December, 1889.

MINES ON DRY WOLF.

The mines in Dry Wolf District are on Lion Creek and Iron Gulch, tributaries to Dry Wolf Creek. The mountain ridges in which these mines are located, are capped with a dark limestone underlaid by beds of varigated argillaceous shales.

All the quartz veins thus far opened are in the above named limestone and show a large amount of excellent ore for the work done. All the veins are capped with oxide of iron carrying gold and silver. There is a very large amount of float, particularly the oxide of iron, on the mountains and in Iron Gulch.

The mines most worked, the Dry Wolf and Gold Dust, were closed up when I was in the camp and could not be examined. Many discoveries have been made and recorded.

Considerable placer mining has been done on Lion Creek; and Iron Gulch is located and held as valuable placer ground, as shown by the prospecting and mining already done in various parts of the gulch.

The Dry Wolf District is well supplied with good timber and water for domestic, mining and agricultural purposes. Dry Wolf itself runs dry sometimes at the mouth of the canyon; but there was at least 500 inches in the creek a mile or more above.

This water sinks and can be raised from bedrock at the mouth of the canyon and be used for irrigation on the agricultural lands in the valley below, or for mining purposes.

And besides, when the placers above are worked the sediment will so puddle the creek where the waters sink, that Dry Wolf will no longer be an appropriate name for that stream.

Williams is an important mine high up in the mountains between Dry Wolf and Barker.

The coal beds on Wolf Creek will supply the mining camps on Running Wolf and Dry Wolf with good mineral coal.

MINES AT NEIHART.

One of the most important mining regions in the Little Belt mountains, is the Montana District at Neihart. Neihart is a well built, substantial mining camp located where the deep rugged canyon widens out to let in the sunshine and free air and give a wider view of the celestial world. Mountains of sienitic granite and porphyry rise on all sides abrupt and rough with rounded and craggy summits. These mountains are cut and intersected by a great number of veins containing oxide of iron carrying gold, sulphurets and carbonates of lead and copper carrying gold and silver.

A great many locations have been made in this district, and so opened as to show up a great number of bright prospects; and a few of them have been sufficiently developed to prove them good mines.

There are two furnaces in this camp. One, a small reverberatory, had just commenced running irregularly on the ores of the Uncle George mine. The other had a capacity of 30 tons, but was idle. There were also two concentrators—both of them closed up, waiting for more development of the mines, and the

development of the mines is waiting for the railroad, which is now making rapid progress from Great Falls, to the relief of this wonderful camp. This road will reach Neihart next year, and many a miner weary with waiting, will be inspired with new life and fresh hopes of a fortune that will give a pleasant ending to a laborious and anxious life. Neihart will soon become one of the prosperous mining camps of the world.

There were only two mines at Neihart, the Monarch and the Mountain Chief, which worked over four men when I was there. These two only, the law made it my duty to examine for the safety of the workmen.

On the Monarch I found the work consisted of the discovery shaft and a working shaft down on the vein 192 feet, showing a vein varying in width from five to sixteen feet; and a tunnel in 200 feet, which will cut the vein in 444 feet at a depth of 365 feet.

This work was well done and made safe for the workmen. This mine is near town, and is in a ridge of sienitic granite so situated it can be worked at comparatively small expense. Six men were at work in the Monarch. There were about forty tons of ore on the dump. Seven tons had been shipped to the Great Falls smelter, which yielded 108 ounces of silver and \$5 in gold per ton. The ore is rich in galena and carbonate of lead and much of it will yield 70 per cent. or more of that metal, which makes it a very desirable fluxing ore to smelt more refractory kinds.

The Mountain Chief and "88" belong to the same company and will be worked together. Four or five veins have been opened on this property. There are four shafts; the deepest is down 310 feet on the vein; and there are seven tunnels which will strike the veins at various depths, the lowest now in 130 feet, will tap the vein 2300 feet in and 1000 feet below the top of the main shaft. I had made only a partial examination of this mine when I was called away from Neihart. As far as my examination went the work was first class and absolutely safe. The second tunnel struck the vein in 700 feet at a depth of 210 feet.

This mine has a double track tramway down the side of the mountain, so run by a wire cable that the loaded car going down takes up the empty one.

It also has a smelter and a concentrator of the Fort Scott pattern and construction.

I examined the Whippoorwill and Uncle George, on Carpenter's Creek some six miles from Neihart, and found several hundred tons of good ore on the dumps of Uncle George; but no

one was at work in the mine. The ores are oxide of iron, copper carbonates, and copper glance, and galena and lead carbonates. A small reverberatory furnace was running on these ores. The mine is worked by a tunnel in seventy feet and shaft sixty feet down on the vein. The Whippoorwill is worked by a shaft ninety feet deep on the same vein, which is in the porphyry foot-hills at the head of Carpenter's Creek.

The Savage, on the opposite side of gulch, Crown Point over the hill, Meeks two miles below, the Flushing still lower, and several other localities on Carpenter's Creek, have been but little worked; but all of them show large bodies of galena for the work done and must be recorded as very bright prospects.

At this stage of my examination of the Neihart mines a summons was received which could not be disregarded, calling me to another part of the State. The examination will be finished at an early day and this report of the mines at Neihart completed.

It may be proper to add, that the supply of pine and red fir suitable for domestic and mining purposes and good water is ample to supply all demands; and there are vast quantities of good coal at Belt and Sand Coulee and Otter Creek, on the railroad to this favored mining camp.

BARKER MINING DISTRICT.

This district is located in the northeast spurs of the Little Belt Mountains, and the Barker mine was the first discovery made in it in 1879. Since then more than 500 claims have been located and many of them have been patented. This district includes a wide area of mountains and valleys, covered with dense forests and watered with numerous never failing streams. In riding over this favored region and seeing the thousand prospect holes, shafts and tunnels, one cannot fail to be impressed with the vast amount of work which has been done by the miners of Barker during the last ten years.

The rocks containing these mines, are granites, sienites, porphyries, limestones and variegated argillaceous shales. The mines are in crevice veins, contact veins, veins of segregation and blanket veins, which are so numerous that prospectors have found but little difficulty in discovering new prospects every year since the first was opened.

These veins are filled with ores of iron, manganese, copper and lead, all of which carry gold or silver, or both. The most of them are smelting ores, which have enough lead, iron and

manganese to make them good fluxes to work with more refractory kinds.

Many of the prospects in Barker have been so developed as to prove them permanent and valuable mines; others show such large bodies of rich ores as to invite liberal investments, and hundreds of others show prospects bright enough to induce further development.

The Silver Bell and the Wright and Edwards have been worked more than any other mines in the district. The Silver Bell has been closed six or seven years and could not be examined. Large quantities of ore have been taken out of it and run in the Barker smelter, and the mine has a good reputation with the miners at Barker. It has the reputation of yielding an average of 21 ounces of silver per ton and 50 per cent. of lead. From eight to ten thousand tons were smelted.

The Wright and Edwards mine, in Dream Gulch, has been worked by shaft and tunnel. It supplied the furnace with some seven or eight hundred tons per month for more than a year. The vein is in granite and porphyry, and the ore at the surface was oxide of iron and carbonates and sulphurets of lead, carrying silver and gold; but deeper down the ores were iron pyrites, galena and blende. These ores yielded in the furnace about forty ounces of silver, besides the gold and a large per cent. of lead.

The Pride of the West is another mine well developed, which shows good mining and large quantities of ore. Some ten tons were shipped to Wicks, which yielded \$87 per ton. Thirteen sacks sampled at Great Falls, gave 220 ounces of silver and some gold.

The Moulton and Tiger have a hard black ore of the oxides of iron and manganese mixed, which is very rich in places. These mines are on Galena Creek.

From some other mines they are taking out and shipping ores to Great Falls and other places; but the freight consumes a large share of the profits, or what will be profits, when the railroad reaches this remarkable camp.

There are two furnaces at Barker. What is called the "old furnace" built at Hughesville, did not run long for want of refractory material for a lining. The other furnace is near Glendennin, on Galena Creek, and is a forty ton water jacket. It was built in 1881, but has not run any since 1883. It smelted the ores of the Silver Bell and the Wright and Edward's mines. It is said the work was stopped on account of some financial

complications. The appearances at the furnace indicated a sudden and unexpected suspension of the work. There are piles of wood and ore, some arranged for roasting; and some of the coal ovens are half charged, as if the work had stopped between two shifts by some unforeseen calamity like an Indian raid or an earthquake. This was a sad stroke to the prosperity of the camp. It cast a deep shadow over many a bright prospect and obscured the fond hopes of a speedy competence then entertained by many patient prospectors and hard working miners. But after six weary years of hopes deferred, these prospects are now growing brighter and these hopes are made stronger by the approaching railroad.

It may aid in forming a just idea of the numerous mines and prospects in the Barker District to see a partial list of those examined and deemed worthy of mention.

Wright and Williams, Pride-of-the-West, Barker, Ledger, Burkhart, Black Hawk, Fashion, Mary W, Ida F, Empire, Madison, Belt, Grace W, Bertie, Carter, Hiawatha, Manhattan, Lynn, Smith, Paragon, Ida May, Moulton, Tiger, Maginnis, Eclipse, Meek's Vein, T W, Harrison, Sunset, Wyandotte, Cosmopolitan, Baltimore, Silver Belt, Zilpha, Fisher, Great Western, Bell Williams, Daisy, Forget-Me-Not, Chamberlain, Red Cloud, Jumbo, May, Edna, Gray Eagle, Alexander, Charlotte and Keystone.

One man has about forty locations on one hill east of the smelter, which were not examined. This list might be increased indefinitely; but those named must be enough to impress one with the great number of mines and prospects at Barker.

Barker has an abundant supply of pure water and more good timber than any mining district in eastern Montana, and will soon be in railroad connection with the great coal fields of Sand Coulee, and Belt Creek and Otter Creek, and perhaps those of the Judith Basin. A prosperous future is dawning upon this favored district. Capital will be drawn to its rich mines and bright prospects, the pick and shovel will convert a hundred bright prospects into productive mines, and the miners, who have remained steadfast through the dark years now coming to a close, will soon meet their reward in hopes realized and honest labor rewarded.

Such are the mining districts of the Little Belt Mountains, and such the mines in the Bigger District, the Yogo District, the Running Wolf District, the William's Camp, the Dry Wolf District, the Neihart District, and the Barker District. And all these mines were discovered in some ten years, in a range of mountains less than fifty miles long and twenty miles wide. It

is difficult to imagine the future of these mountains, when all have been prospected and when two or three hundred mines will be filled with workmen; when fifty furnaces will be melting the bullion from their ores, when a thousand cars are carrying it to the marts of the world, and when a score of prosperous towns and villages are crowding the beautiful valleys and growing up the sides of the grand old mountains of the Little Belt range.

PARK COUNTY MINES.

Park county has several important mining districts. The New World Mining District, including Cook City, Crevice Mountain District, Bear Creek placers, Crevice Gulch, Emigrant Gulch, Mill Creek, Boulder District, Copper District, and Rocky Fork mines. There are also several coal mines, Red Lodge coal mines, Bear Creek coal mines, Cokedale coal mines, Cinna-bar coal mines and Horr coal mines.

Emigrant Gulch was one of the earliest discoveries in the county and the Rocky Fork mines are among the latest.

There are four smelting furnaces in the New World District—one at Nye City, two at Cook City, and one on Miller Mountain. The first, at Cook City, was erected in 1877. It run sixty ton of bullion from the ores of the Republic, the Shoo-Fly and the Elk Horn. This bullion remained in the furnace till the raid of the Nez Perces, who carried away some of it for bullets and cached some for future use. They also cut up the belting and bellows for the leather. The other smelter at Cook City was erected in 1883. It has smelted the ores of the Republic and Shoo-Fly and New World and 422 tons of bullion was produced. Another furnace, the "Hartfeldt Portable Furnace," was put up on Miller Mountain, but it was not a success.

CREVICE MOUNTAIN MINES.

East of Bear Creek a mountain spur begins at the Yellowstone and rises northward up into the Snowy range, which extends south and east up the east and north sides of the Yellowstone. This spur, called Crevice Mountain, is made up of slaty sandstones and granites, which are intersected by some of the best defined veins of quartz ever discovered in this State. They are large and regular in size, but very variable in richness.

The Crevice mine is a regular vein of good quartz, running through the Highland Chief, Mizpah and Summit claims. Another vein parallel with the last, cuts the Summit and Granite claims forming the Gillis mine. There are large bodies of vari-

able ore in these mines. Farther up to the north are the Legal Tender, Graham, Mountain Chief and Tiptop, which are deemed very valuable mines.

The Jo. Brown arastras were erected on Bear Creek to work the ores of these mines. It was propelled by water. This arastras worked some thirty tons of the Graham mine and obtained \$40 per ton, and about 125 tons of the Legal Tender ore.

Another arastras was built on the Highland Chief and worked the ores of the Crevice mines with marked success; but exact figures could not be obtained.

A quartz mill called the Pomeroy Pulverizer, was erected on Bear Creek to work the ores of this district. This mill was run for some time on the Legal Tender ore and on the ore from the Crevice mines. The mill did not succeed in saving the gold, although a large amount of free gold was found in the tailings by the pan test. This mill was moved to some place near Drummond.

The Thompson is some distance back of the Gillis; and the Empire State is on Pine Creek, a branch of Bear. These mines are on strong veins of good quartz, containing oxide of iron rich in free gold. Below permanent water the iron containing the gold, will be sulphuret of iron or pyrites.

As a result of these practical tests and assays and a large amount of development work, the mines of Crevice Mountain are held in high estimation by all who know them.

CREVICE GULCH PLACERS.

Good placer mines have been worked in Crevice Gulch since 1868.

BEAR CREEK PLACERS.

Bear Creek Placers have been worked since 1883, with a good supply of water, a pressure of 410 feet and a giant that would carry 800 inches of water. All thought the golden sands of Bear Creek could be cleaned up with such appliances; but it was soon discovered that these golden treasures were locked up beneath vast beds of cement so hard and tough that all the powers of giant and water would make but little impression on them; and other means were used to prove up the old channel. Careful exploration has proved the channel to be 203 feet from rim-rock to rim-rock, and filled to a depth of sixteen feet with rich golden sands. This channel has been followed 2,000 feet

and the "pay dirt" still continues where the glacier of Bear Creek left the rich treasures it had ground out of the quartz veins above.

The quartz mines of Crevice Mountain will soon aid the placers of Bear Creek and Crevice Gulch to keep Montana in the front of the mining states.

MINES OF EMIGRANT GULCH.

Emigrant Gulch is on a tributary of the Yellowstone which comes down from the Snowy Mountains above Livingston. The placer mines of Emigrant Gulch acquired a widespread reputation at an early day in the history of Montana mining, and a large amount of gold was taken out by primitive modes; and much more remains to be cleaned up by the more efficient modern appliances.

As was to be expected many quartz veins have been discovered in and above the famous placer deposits of this rich gulch. Miners and experts agree that these quartz veins contain large quantities of rich golden ores, and they certainly add a large amount to the available mineral resources of Park county.

MILL CREEK MINES.

These mines are on Mill Creek, a tributary of the Yellowstone, which comes down from the Snowy Mountains some twenty miles above Livingston. The Silver King, Silver Mountain, Alice, Emma, St. Paul, Genet and other lodes, have been consolidated by a company organized to develop the discoveries made in this region. This is a step in the right direction, and those well informed predict a successful issue of this enterprise.

THE BOULDER MINES.

These mines are on Boulder Creek, about thirty miles north of Cook City. Placers have been worked here for several years and some remarkable quartz veins have been discovered.

The Hidden Treasure is a large vein which has been cleaned off by placer mining 150 feet in length and thirty feet in width. The quartz is very rich in free gold in many places. Some specimens showed numerous particles of gold; in other places the quartz appears to be nearly barren. This is certainly a very "bright prospect," and we may expect to hear pleasant things from the Hidden Treasure on the Boulder of Park county. Judging from what I saw the name should be Visible Treasure rather than Hidden Treasure.

MINES AT COPPER.

About six miles from the Boulder mines are some copper veins at Camp Copper. These mines are held in high esteem; but not enough work has been done to convert the bright prospects into good mines.

ROCKY FORK QUARTZ MINES.

Some quartz veins have been discovered on Rocky Fork Creek six or eight miles southwest of Red Lodge. These discoveries have not been examined, but they are in the midst of a wide region of low, rounded knobs and ridges similar to the Granite and Limestone ridges at the head of Stillwater, in which so many good veins have been discovered.

THL COOK CITY MINES.

Cook City is in the New World District, which includes many mountains and valleys intersected by numerous large, rich, and in some respects, very remarkable veins and deposits of rich ores.

Geology.—The geology of a district usually indicates to some considerable degree the nature of its mineral deposits. Productive veins of the precious metals are found in no place save in regions where the rocks have been metamorphosed and more or less crystalized as is most common in mountains and the adjacent country. But in some places the rocks are metamorphosed far away from the mountains as in some parts of New England. This is more common where the rocks belong to the oldest formations. But the more recent rocks of the gold and silver regions of the United States are never metamorphosed far away from those influences which elevated, fractured and tilted the rocks which form our mountains. Hence, veins of gold and silver are never found in those regions far away from the mountains and foothills.

But while productive veins of the precious metals are never found in any save metamorphosed and igneous rocks, it is not true that all metamorphosed rocks contain such veins.

Some mountains contain but little gold and silver, and even some parts of very productive ranges, produce none of the precious metals. But nearly all mountain ranges yield some valuable materials for man's use. While the Ozark mountains have furnished no valuable mines of gold and silver, they have vast

deposits of iron, lead, zinc, copper, nickel, cobalt and marble. The northern part of the Alleghanies furnish large quantities of slate, marble and mica, the middle portions anthracite and iron, and the southern portions gold, mica and marble.

Some have imagined that the most ancient rocks are the richest in the precious metals. But this is a mistake. While the iron mines of the Ozarks and Adirondacks are in the oldest rocks and mountains of the continent, and the anthracites of the Alleghanies are in mountains more recent, the gold and silver mines of the Rockies are in mountains comparatively new.

The whole region of the Rockies, the Sierras and the Cascades, was under the Pacific ocean when the Alleghanies were formed.

So this whole region of the Rocky Mountains and the Pacific slope, so rich in precious metals, is as comparatively recent in the geological ages as its civilization is in the historical times.

The highest mountains about Cook City present a feature which, though common in this part of the Rocky Mountains, is seldom seen in the mountains of the Atlantic coast. Mountain ranges and spurs and peaks usually appears as if the central and highest portions had been forced up through the horizontal surface strata, leaving the latter fractured, tilted and lying against the sides of the mountains. But in the highest mountains at Cooke City, the central and highest peaks have been forced up through the horizontal surface rocks as stated; but instead of tilting the surface strata, the disturbing forces lifted them bodily to a height of some 8,000 or 10,000 feet and left them in a horizontal position as before they were disturbed.

Another uncommon feature is quite obvious in these high mountains. The horizontal strata which form the sides of the mountains are but little changed on their outer edges, but they are much more metamorphosed and fractured next to the basalts and trachytes or ancient lavas, which form the central peaks and ridges. Hence many of the best mines in these mountains are in these metamorphosed rocks near to or in contact veins next to the central basalts or ancient lavas. This is true of the Morning Star, Black Warrior, Homestake, Elkhorn, War Eagle and many other mines. This class of mines is in fissure or contact veins.

Other mines in these mountains are what the miners call "blanket veins." They lie nearly horizontal between the rock strata. Others still appear to be irregular veins with vast pockets filled with ore, usually in or adjacent to the limestones.

Such is the geological structure of the high mountains known as Miller, Henderson, Woody, Republic, Sheep and Red

mountains. These mountains are actually covered with hundreds and hundreds of mineral locations. Some have been so well developed as to show their value and prove them good mines; while the greater number have been but little worked and are simply bright prospects.

At the head of Stillwater and Slough creeks are some low, rounded mountains or foothills, called Granite Range and Limestone Range, which contain many important mines. There are also large areas on the headwaters of Soda-Butte Creek, Rocky Fork and Clark's Fork covered for the most part with low, rounded knobs and ranges, which have been but little explored, though some mines have been discovered in them. This is a promising region and will be prospected as soon as the railroad whistle startles the deer and the elk and the bear from these wild regions and promises cheap transportation. The picks are already sharpened, the shovels are bright and the donkey and the cayuse are ready to pack the grub for the pioneer miners, who shall develop these vast regions whose mineral veins have not yet felt the blows of the prospectors, whose discoveries have covered the Pacific Slope and filled these mountains with civilized states with a rapidity that surpasses all historical records and even the magical results of Aladdin's lamp.

The pioneer prospector may live in his log cabin, his tent or even his brush wicky, but when the true history of America is written, he will have a monument quite as creditable as the marble palaces of the millionaires his discoveries have made.

Cooke City is surrounded by lofty mountains with pointed peaks and sharp ridges surrounded by rounded foothills. These mountains to the very summits are intersected with numerous mineral veins containing iron, lead, zinc, copper and manganese, all carrying silver and gold.

This whole region drained by the headwaters of Soda-Butte Creek, Clark's Fork, Rosebud, Stillwater and Rocky Fork, belongs to the New World Mining District.

It is believed that fully one thousand claims have been located in this district since its organization.

Among the mines and bright prospects in this district are the following:

On Miller Mountain are Morning Star, Shoo-Fly, Stump, Novorbis, Nellie, New World, High Ore, Washington, Volunteer, Alta California, Richmond, Ash, Uncle Sam, White Cross, Comet, Red Cross, Josephine, Talc, Monitor, Exchequer, Big Blue, Pine Nut, Balam's Ass, Revenge, Yellowstone, Day Light, Rising Sun, Iceberg, Rob Roy, Silver Lead, White Lily, Alta,

Chief Justice, Little Judge, Street, Bunker Hill, Sheol, Harrison, Nevada, Fairview, Albion, and many others.

On Henderson Mountain are Alice E, Unicorn, Homestake, Daisy, War Eagle, Forget-Me-Not, Bonanza, Mountain Lion, Hidden Treasure, Isabella, Rising Sun, Snow Bird, Mountain Sheep, Como, Rhode Island, Naragansett, Puck, New Year's Call, Ivanhoe, Little Queen, Sunny Side, Magnetic Iron, Long-street, Silver Queen, Lady Henderson, Pick-up, Snow Slide, Silver Wonder, Silver Zone, Leopard, International, Young America, Never Sweet, Diadem, Little Blue, Henderson, White Pine, Cleveland, Wisconsin, Highland Maid, Tiger and others.

On Sheep Mountain are Silver King, Saturn, Warrior Chief, Orange Blossom, Little Kid, Longfellow, Idlewild, White Warrior, Borland, Golden Fraction, Enterprise, Progress, Commonwealth, Traveler, Proctor Knot, Orphan Boy, and Golden Terry.

On Republic Mountain are the Republic, Black Warrior, O'Hara, Greeley, Grubstake and others.

On Woody Mountain are Comstock, Eclipse, Queen Esther, Horrible, Vermont, Plain View, E. C. Waters, Myrtle, Volunteer, Montana Boy, Cache-of-Ore, Ore-of-Cache, Norway, Jupiter, California, Rosella and others.

On Red Mountain are Elk Horn, Isabella, Seg. Belcher, Boulder, Gela, Great Eastern, Bonanza, New-Years'-Gift, Melissa, Bull-of-the-Woods, Estella, Alabama, Elk-Horn Extension and some others.

On Crown Butte are Talisman, Stand-off, Lady Washington, Democrat, Bogus, Ben. Franklin and Black Warrior.

In Wolverine Pass are Blue Bird and Cavern.

At the head of the Stillwater and Lake Abundance are Stillwater, Monroe, Josephine, Moulton, Mammoth and many others.

The people of Cooke City and the New World Mining District belong to the men who have made the country profitable for railroads, and they hope that the railroads will speedily come to take their bullion to the eastern market at such cheap rates that they can afford to work out the millions and millions now in sight and yet to be developed.

The ores from the Republic, Shoo-Fly and New World produced 422 tons of bullion and still the mining and smelting did not pay. The low grade of the bullion and the cost of the transportation have caused the smelters of Cooke City to shut down and the miners to quit work, save what is necessary to

represent and hold their claims until such time as cheaper transportation will enable them to make a fair profit on the output of their mines and furnaces. Notwithstanding this delay of profitable returns, neither the prospectors who discovered these mines, nor those who have purchased interests in them, have lost faith in the final results; all are holding on for "the whistle of the iron horse." When he comes the New World District will be alive with men, teams and smelters, and the railroad will have its trains loaded with coke and the bullion of the mines now idle for want of cheaper transportation.

WATER AND TIMBER.

One of the features of this New World District is its extensive dense forests of pine, fir and spruce, with here and there a patch of aspens, willows and alders. From the tops of the mountains about Cooke City, one can see a vast area of mountains and valleys covered with dark, thick forests, save the naked mountain peaks and here and there a small prairie on the mountain slopes and in the narrow valleys.

These forests continue for twenty miles to the west down Soda-Butte Creek, and for fifty miles along the Snowy Mountain slopes to Bear Creek, and for twenty miles north along the mountains and down the Stillwater and the Rosebud, and for thirty miles east to Rocky Fork and Clark's Fork, and south as far as vision extends over the headwaters of Clark's Fork and the East Fork of the Yellowstone. Here we have a vast forest region covering an area of some 2,000 square miles, ample to furnish fuel and timber for the thousand mines which will be worked in this region.

But the timber and the fuel are only a small part of the benefits these forests bestow upon this favored region. In the autumn of 1889, after the dryest spring, summer and autumn ever known in Montana, the mountains and valleys of this forest region were literally sparkling with cool springs and running streams.

Timber and water are prime necessities in mining. Both are now abundant in the New World Mining District. Let all insist that the forests and fountains shall be preserved through the thousand years these mines shall be worked. If not these glorious wooded mountains will soon be made hideous with blackened stumps, naked rocks, spring floods and fountains and streams dry in summer and autumn. What then will mining be at Cooke City?

THE COAL MINES OF PARK COUNTY.

The coal mines of Park county have already acquired some of the reputation which they so richly deserve. The Cokedale mines, the Horr mines, the Bear Creek mines and the Rocky Fork mines are known to contain enormous quantities of excellent caking and dry coals.

These coals are sometimes called *lignites* because they belong to the *lignite formation* of the geologists, which is so named from the beds of lignite found in it. But the coals in the mines above named are as true bituminous coals as any in the regular coal formation in Ohio or Pennsylvania.

The Horr Coal Mines are in the foothills of the Cinnabar Mountains on the Park Branch railroad. These mines furnish an excellent caking coal, and have forty coke ovens with a capacity of sixty tons of coke per diem. It is said this plant will be increased.

Cokedale Coal Mines are in the great Bozeman coal bed, which extends from Yellowstone Canyon across the range to Timberline and beyond. The work in these mines is well done and great care is taken to make them safe. They are well timbered and thoroughly ventilated. They now have 80 coke ovens and the plant will soon be increased to 100. The daily output of coal is some 200 tons, which yield about 100 tons of excellent coke. This coke is used in the smelters at Helena, Wickes and Butte.

The most of the coal at Cokedale belongs to the chippy variety, which breaks up into small lenticular fragments and scales. It makes a strong light coke with a bright metallic lustre and sharp ring. It separates into long polygonal pyramids. The coke is sometimes spun out into long slender threads, which fall together in tangles like "Peele's" hair spun from the lava of Mouna Loa.

Some of the coal used in making this excellent coke is washed by a very extensive and efficient apparatus to free it from such impurities as would increase the ash and decrease the heating powers. About 250 men are employed at Cokedale.

The Cinnabar Coal Mines are on the east side of the Yellowstone near Cinnabar, where the same coal beds have been opened and so developed and proved up as to show the coal is well suited for the manufacture of gas and coke. It has been used in the Helena gas works and coke ovens will be erected there in the near future.

Bear Creek Coal Mines are located on Bear Creek, a tributary of Clark's Fork and about six miles east southeast of Red Lodge. These coal mines are in an extension of the great coal field which contains the coal beds on Rocky Fork.

These mines are in Sections 6, 7, 8, 12, 17 and 18 of Township 8 south and Range 21 east; and they are located on five successive beds of coal from the lowest to the highest as follows:

The first bed contains five feet of coal. Above this bed are about 200 feet of sandstones and shales. Then comes the

Second bed, which contains four feet of coal; and above it are forty feet of sandstones and shales. Then comes the

Third bed with nine feet of coal, which contains charcoal partings and numerous globular concretions of impure coal. Above this bed are about 200 feet of sandstones, shales and clays up to the

Fourth bed with six feet of coal, which is followed by 150 feet of sandstones and shales succeeded by the

Fifth bed of coal, four feet thick. On this coal rests some 300 feet of shales, sandstones and clays containing several small seams of coal.

These coals are all good in quality and belong to the non-caking or dry coals save perhaps the upper bed, number five, which looks like a caking coal. Some 200 tons of coal in number three, were taken out in large blocks in January, 1888. In June, 1889, it showed no signs of slacking or crumbling, after being exposed to the weather the most of two winters and all of two springs and one summer and fall.

Four beds of coal are exposed on Section 36 of Township 7 south and Range 21 east, and Sections 31 and 32 of Township 7 south and Range 21 east. These beds vary from four feet to six feet in thickness and lie between the Bear Creek coal beds and the Rocky Fork mines.

Rocky Fork Coal Mines are located at Red Lodge, at the terminus of the Rocky Fork railroad. These beds are in the lignitic formation of the cretaceous rocks, and the coal beds of this formation have been traced all the way from Bear Tooth Mountain on the west to Clark's Fork on the east. Some twelve different beds of good coal have been opened within a mile of Red Lodge, but only five of these have been worked. The output of these mines now is between 600 and 700 tons *per diem*. This can be increased indefinitely, as the facilities for working are added to meet the demand.

The five beds worked at Red Lodge are opened in the bluffs of Rocky Fork within a distance of 1620 feet, and show an aggregate thickness of 65 feet of good, merchantable coal.

Coal engineers estimate the yield of good bituminous coal at 1,000,000 tons per square mile, which would be 65,000,000 per square mile of these five coal beds. The other seven beds, one of which is 9 feet thick, would increase this amount fully one-half, or to 97,500,000. But these beds dip to the south at angles ranging from 15 to 25 deg., or an average of 18 deg. This dip would increase the quantity on each section of this coal land to more than 102,000,000 tons; and each square mile would furnish 1,000 tons on each working day for 300 years.

Several coal beds crop out on Sections 2 and 11 of Township 2 south and Range 10 east; but they have not been sufficiently developed to show their value.

There are coal croppings on the north side of the Yellowstone in the foothills of the Snowy Mountains, between Cinnabar and Gardiner, and a bed of good coal is worked on the east side of the Gardiner River, in the National Park.

FIRE CLAY OF PARK COUNTY.

There is a large bed of good fire clay near Cook City. Bricks from it showed excellent refractory qualities in the furnaces at that place. Fire clays are abundant in nearly every County in the State.

IRON ORE OF PARK COUNTY.

Several deposits of iron ores were observed in Park County, but the most important was examined in Bear Creek coal field. This lode of iron ore is in a crevice vein from 5 feet to 20 feet wide, which cuts the coal-bearing rocks in a direction nearly southeast and northwest. The vein is nearly perpendicular, and can be traced by the croppings for ten miles and a half through Sections 1, 6, 7 and 8. This ore is similar to the black-band ore, so much used in Wales.

From this very short description of the mines in Park County, one can safely predict a brilliant mining future for this part of Montana. There are a score of mines so far developed as to make it certain they will yield large quantities of very rich ores; also a hundred prospects fully as promising as were our best mines at the same stage of development; and a thousand prospects, some of which may make a Drum Lummon or an Anaconda.

There is an abundance of coal of all qualities needed for domestic manufacturing, mining and railroad uses. No County in the State, save one, has so large a proportion of timber land, and none is better watered.

RAILROADS IN PARK COUNTY.

Park County has four railroads and a fair prospect of two more, which will give cheap transportation to all the mining districts. With these natural and railroad advantages the miner and the capitalist will scarcely find a more promising field for labor and investments.

COAL OF CUSTER COUNTY.

Miles City coal field, which lies on the south of the Yellowstone and west of Tongue River, furnishes an abundant supply of cheap fuel for Miles City and the surrounding country. Just how extensive these coal beds are and how much coal they will furnish, is not fully known. They have as yet given no indications of petering out.

Pumpkin Creek coal field is another coal area in Custer county on S. L. Creek, an eastern branch of Pumpkin Creek, and sixty miles south of Miles City. This coal series has one bed of good coal 14 to 16 feet thick and several thin beds. This bed is very important in a county of scant timber and it has been opened and worked for local uses.

Pumpkin Creek coal gives the following assay, given in comparison with Rocky Fork coal and Rock Spring coal in Wyoming:

	Pumpkin Creek Coal.	Rocky Fork Coal.	Rock Spring Coal.
Specific Gravity	1.36	1.32	1.28
Moisture at 212° F.	12.45	2.50	1.30
Volatile Matter	47.10	46.12	49.80
Fixed Carbon	34.45	46.20	42.80
Ash	6.00	6.01	7.40
Weight per cubic foot	85.00	82.50	80.00

Little Pumpkin Creek coal field has a coal bed twelve feet thick on Little Pumpkin Creek, about twenty miles southwest of the S. L. Creek mines.

Powder River coal mines are on Powder River, near the boundary between Montana and Wyoming. But little is known of this coal field. Those who have seen it are favorably impressed.

Coal has also been discovered in T. 7 N. R. 41 E., T. 8 N. R. 44 E., and in T. 10 N. R. 48 E., on the north side of the Yellowstone; and in T. 6 N. R. 48 E., east of Tongue River.

Rosebud coal field is situated in T. 5 N. Rs. 41 and 42 E., and T. 2 N. Rs. 41 and 42 E., on the west side of Rosebud River.

These coal fields, situated in the various parts of the county, show that Custer will have an abundance of good fuel to supply all demands for domestic and other uses.

COAL OF YELLOWSTONE COUNTY.

The Bull Mountain coal field is the most noted coal deposit in that part of the State. The mountain is composed of horizontal strata of the coal bearing rocks left by the forces which denuded the surrounding country. It lies between the heads of Wild Horse and Parrot Creek, tributaries of the Musselshell, and Razor Creek, a tributary of the Yellowstone, and nearly half way between the two rivers. It covers an area of some fifty square miles; and this whole area is underlaid with many coal beds—three or four only are thick enough to work. The thickest, or Mammoth Bed, has from ten feet to fifteen feet of workable coal, and will yield about 500,000,000 tons. And the other beds will yield about 300,000,000 tons more, or in all 800,000,000 tons of available coal in Bull Mountains.

This coal has some of the characteristics of lignite, and is by some called a lignite. It crumbles on exposure; has considerable sulphurets of iron in concretions and in thin scales in the seams and joints and gives off sulphurous odors in burning, and the coal will be injurious to all metals in contact with which it is burned. It will, however, be a valuable fuel for many uses in a vast prairie country.

COAL BEDS OF FERGUS COUNTY.

There are several very important coal fields in Fergus county. One extending from Folsom Creek across Swimming Woman's Creek to Careless Creek some twenty miles in length; one near Fort Maginnis: one six miles northwest of Maiden; one at Plum Creek, north of Moccasin Mountain; and another extending from the Judith River across Sage, Willow, Skull and Wolf Creeks, in a northwestern direction.

These extensive coal regions have been but little explored and worked, but enough has been done to show they contain vast quantities of available coal suitable for all ordinary uses.

The Judith River coal bed, extending from Judith River to Sage, Willow, Skull and Wolf Creek, is the same bed as that at Sand Coulee and Belt Creek. Here it varies in thickness from five to ten feet with some shale partings.

The coal has a jointed structure, jet-black color, resinous lustre and conchoidal fracture. It is bituminous, burns freely, and gives good satisfaction. This coal field contains immense quantities of good coal.

Plum Creek coal lies on Plum Creek, at the northeastern end of North Moccasin Mountain, and has eight and ten feet of good coal.

The Maiden coal bed, opened six miles west northwest of Maiden in Sections 31, 32 and 33 of T. 17 N. R. 19 E., has from two to three feet of good bituminous coal. It appears to cover a large area of the country.

I have not seen the beds south of Big Snowy Mountains and can not speak of the quantity and quality of the coal there; but the facts reported prove these coal beds cover a large area.

Fort Maginnis coal has been opened in several places on the Reservation and in T. 16 N. and R. 20 E. This bed where opened is from two to three feet thick and the coal has a good name among those who have used it. It is a bituminous coal.

MEAGHER COUNTY COAL MINES.

While Meagher County is wonderfully rich in her gold, silver, copper, lead, iron and manganese mines, no very extensive coal veins have been discovered and developed. There are, however, good prospects on Sixteen Mile Creek, in the southwest corner of the county, and on Careless Creek in the extreme eastern part, and in the Murray District in the western part. When properly developed, these discoveries may prove extensive and valuable deposits of mineral fuel.

COAL MINES IN CASCADE COUNTY.

Cascade County, while it has a scant supply of timber save in the Highwood and a part of Little Belt Mountains, is favored with a vast amount of excellent coal, well distributed over the county. Coal beds have been opened on both sides of Sun River, below Sun River Crossing; on Muddy Creek; in the Missouri River bluffs, north of Ulm; on Willow Creek; on Hound Creek; on Deep Creek, both above and below the mouth of Hound Creek; in Sand Coulee; on Belt Creek, and on Otter Creek.

Willow Creek Coal.—There is an outcrop of excellent coal on Willow Creek, southeast of Cascade, at the northern extremity of the Belt Mountains. The *strata* here are very much disturbed and broken up, so that it was impossible without more work to tell the extent and thickness of this bed.

The Deep Creek Coal Mines have been opened on Hound Creek, on both sides of Deep Creek below the mouth of Hound Creek, and on the east side above. From a tunnel on the east side considerable quantities of this coal were shipped to Benton, Sun River and other markets.

This coal bed is about six feet thick, and covers a considerable area, as shown by the openings made on it. It comes to the surface at Spanish Coulee, but has not been opened to prove its quality or quantity at that locality. This coal must prove useful, as it will furnish a very large quantity of excellent fuel, suitable for all ordinary uses.

Sand Coulee Coal Mines.—At Sand Coulee the same coal bed has been traced over a large area, where it occupies a position most favorable for mining and transportation. This coal bed has been opened and worked in numerous places on Sand Coulee and on Cottonwood Coulee for a distance of several miles. The bed lies nearly horizontal, and from 20 to 75 feet above the bottom of the Coulees and the railroad track: a position most favorable for mining, and loading wagons and cars.

The principal openings are by tunnels in the Largent mine, the Sand Coulee Coal Company's mines, the Dean mine, the Humphrey mine, the Culberson mine, and several others. In these mines the coal varies in thickness from 5 feet to 16 feet. There are some shale partings, thickest where the coal bed is thickest; but the shale can easily be separated in mining.

Quality of Sand Coulee Coal.—Some persons have called this a *lignite*, because it is found in a formation which contains beds of lignite; but this is as true a bituminous coal as can be found on the continent. Like the "block coals" of Ohio, Indiana, Illinois and Missouri, so much used in hot-blast furnaces without caking, it contains numerous thin layers of charcoal, which prevent the coal from caking and choking the furnace. In fact, the Sand Coulee coal bed is made up of three varieties of coal: a jet black variety, with shining, resinous luster and an even or conchoidal fracture, which makes a first-class coke, a dull, dry variety, with little bitumen, and mineral charcoal, with very little bitumen, all more or less interstratified. The bright, caking coal is most abundant towards the bottom; the dull, dry coal prevails in the upper part of the bed, and the charcoal partings in the middle part.

I have had a number of analyses made of each of these varieties of coal by Prof. J. T. Gove, of the Utah Assay Office, in Helena, and by Prof. Frank W. Traphagen, of the College of Montana, at Deer Lodge.

The caking coal has a shining luster, and breaks with an even or conchoidal fracture. The average of two analyses made by the above named experts, gave the first in the following table:

	Sand Coulee Coal.	Conn'lsville Coal.	Pittsburg Coal.
Specific Gravity.....	1.24	1.28	1.25
Water at 212° F.....	3.98	4.50	3.00
Gas or Volatile Matter.....	33.15	24.00	33.76
Fixed Carbon.....	57.05	65.00	54.93
Ash White.....	5.83	6.50	7.07
Coke	62.88	71.50	62.00
Weight per Cubic Foot.....	77.50	80.00	78.12

The above table shows the ingredients of the bright caking part of the Sand Coulee coal, together with the very celebrated Connellsville coal of Pennsylvania, so esteemed for making coke for foundry uses, and the well known Pittsburg coal so generally used in the gas works of the country. The analysis of the Connellsville coal is taken from the Geological Report of Indiana for 1875, and the analysis of the Pittsburg coal from the Reports on the Coals of America to the Secretary of the Navy, by Walter R. Johnson.

By a comparison of these analyses it will appear that this Sand Coulee caking coal as closely resembles these two most celebrated coals of America as two specimens of coal from the same bed resemble each other. This variety of the Sand Coulee coal is almost identical with the celebrated Connellsville caking coal. This and the several practical tests in coking this coal, show it to be a good coking coal.

I have three specimens of excellent coke, two made from the Sand Coulee coal and the other from the Belt creek coal, which are identically the same, as both mines are in the same coal bed, and no expert can distinguish the coals from the two localities. Many experts declare this an excellent coking coal.

The most striking resemblances between the Pittsburg coal and this variety of the Sand Coulee coal, are in the amount of gas, the specific gravity and the fixed carbon, showing this shining variety of the Sand Coulee coal will make about the same amount of gas and coke as the Pittsburg coal and has less ash.

The dull, dry variety of the Sand Coulee coal has a dull, even or conchoidal fracture; and the charcoal shows the grain

and pores of the plants from which it was formed. These varieties give the following analyses. The analyses of the two last varieties are given in the following table:

	Dry Coal.	Charcoal.	Average of three varieties
Specific Gravity.....	1.37	1.36	1.33
Water at 212° F.....	2.81	2.25	3.01
Gas or volatile matter.....	29.43	25.10	30.23
Fixed carbon.....	66.50	65.60	59.71
Ash-greyish white.....	11.27	7.05	7.05
Coke.....	67.77	72.65	66.76
Weight per cubic foot.....	85.75	85.00	82.75

These analyses show the charcoal has the least water, the least gas and the most fixed carbon. Though the charcoal forms numerous thin partings in the coal, it really constitutes a very small portion of the whole bed. But small as it is in quantity, it is a very important feature of this coal, for it prevents the coal from caking and choking or clogging the furnace. These charcoal partings make a part of this bed of *block coal* almost identical in structure and composition, with the celebrated block coals so much used raw in the iron furnaces of Ohio and Indiana.

The following table gives side by side the average analyses of all the varieties of coal in the Sand Coulee bed and of the block coals of Clay and Owen counties, Indiana, as given in the Geological Report of that State for 1875. A careful comparison of these analyses and scores of others made of the block coals of the country, and also a comparison of the physical structure of these coals, will place the middle part of the Sand Coulee coal in the list of block coals:

	Sand Coulee Block Coal.	Clay Co., Ind., Block Coal.	Owen Co. Ind. Block Coal.
Specific gravity.....	1.325	1.23	1.25
Water at 212° F.....	3.01	3.33	2.50
Gas and volatile matter.....	30.23	35.70	36.00
Fixed carbon.....	59.71	56.00	57.00
Ash-greyish white.....	7.05	5.00	4.50
Coke.....	66.76	61.00	61.50
Weight per cubic foot.....	82.75	75.98	78.12

These two analyses of block coals from Clay and Owen counties, Indiana, are very similar to that of the Sand Coulee coal in chemical qualities. These three coals are as near alike as samples from the same coal bed usually are, as is proved by many analyses published in the Geological Reports of Indiana and other States. This, like the block coals of Indiana, breaks into large blocks, as shown by all the coal taken out. These

analyses, as given above, show the Sand Coulee to be a high grade coal for domestic uses, for making steam and for smelting furnaces either with or without coking. This coal has two slate partings and sometimes a little sulphuret of iron, which can be separated in mining. A neglect to separate the slates in mining has given this coal a bad name in some markets. Its use for domestic purposes in several of our towns and its general use on the Montana Central and Manitoba railroads from Butte, Montana, to Grand Forks, Dakota, and at the Great Falls reduction works, have given this coal a reputation and made a demand for it greater than the mines now worked can supply.

This coal has been used raw in smelting our copper ores and pronounced an excellent fuel for that purpose.

The physical properties of this coal, the numerous analyses of it, and its use for all purposes, fully prove that it is an excellent fuel for domestic use, for generating steam and roasting ores; that the lower part will make good gas and coke, and that the middle part is a block coal suitable for use, raw, in smelting furnaces. The Sand Coulee coal is hard and strong, breaks in large blocks, and makes very little dust and waste in handling. It is a clean and popular domestic coal.

Facilities for Working.—Nearly all the coal at Sand Coulee is sufficiently high above the railroad to be dumped directly into the cars on the track, and give ample space for shoots, screens, and all necessary appliances for the cheap handling of coal. The cap of the coal is a hard, strong shale, and thick beds of strong sandstone. It is impervious to water, save where cracked, and secures dry air and comfort to the miners. Little or no timbering is needed to make the mine safe. This secures cheap and healthful working, and safety from fires. The upper shale parting makes a strong roof for working the lower six or seven feet of the bed, when desirable to work the two parts separately. The bed rises sufficiently to the west to secure perfect drainage towards the railroad, as in the present tunnel, whose mouth is only 420 feet from the track of the railroad. This dip of the bed to the east will not only give a good drainage to the mine, but also enable the coal cars to run out by their own weight, or with very little assistance. A side track to the shoot and screens would cost but little, the distance is so short, and the ground level from the dump to the railroad. Nearly all the mines at Sand Coulee possess the same facilities for working. Very few coal mines are so favorably located for economical working and cheap transportation to market.

The Sand Coulee Coal Company are working 500 men, and are taking out some 1,700 tons *per diem*. This amount will

be increased as fast as the mines can be opened. So far the demand is greater than the output.

Belt Creek Coal Mines.—The same coal bed found on Deep Creek and at Sand Coulee has been opened in several places on Belt Creek at Belt City. The position of the coal bed is nearly horizontal, and sufficiently above the bottom lands to be mined and put in cars and wagons at very low rates, nearly as above described in Sand Coulee coal. The quantity and quality of the coal on Belt Creek is the same as that at Sand Coulee. In fact, it seldom happens that the coals in two localities on the same bed so far apart as Sand Coulee and Belt Creek, agree so perfectly in position, thickness and character of the vein, and in quantity and quality of the coals, and facilities for working.

Sand Coulee has the advantages of position for loading cars, and being in the midst of the best agricultural region on the Upper Missouri; and Belt Creek has the advantages of an abundance of water and large supply of timber in the adjacent Highwood Mountains.

Missouri and Sun River Coal.—There are two coal beds in the bluffs on the south side of Sun River, two miles below the Crossing. One of these beds is four feet thick and of medium quality. The other bed is thin and would not pay for working while labor and coal command present prices. These beds are nearly horizontal and sufficiently high above the water to be worked with ease.

A bed of coal similar to that on Sun River crops out in the bluffs of the Missouri below Ulm. It also comes to the surface in a coulee between Sun River and the Missouri. These facts in connection with the horizontal position of the rocks between Sun River and the Missouri, indicate the continuation of these beds of coal in the bench lands between those rivers.

A coal bed also crops out in the bluffs on the northeast side of Sun River in places for several miles. This coal bed doubtless underlies a large area in the bench lands to the north and east.

Muddy Creek Coal.—One or two beds of coal similar to those on Sun River, have been opened in several places on Muddy Creek, in the northern part of the county. These beds will be useful to supply the local demands for domestic uses.

Quantity of Coal in Cascade.—The coal beds at Belt Creek, at Sand Coulee and on Deep Creek will yield 6,000,000 tons per square mile. As the area underlaid by this coal at each of these locations has not been determined, it is impossible to tell how many square miles have it; but it is safe to say they cover an

average of six square miles at each of these localities, and probably many more, and will furnish 36,000,000 tons of marketable coal, or a thousand tons *per diem* for the next hundred years. By the time these coals are exhausted some better mode of warming the cold regions and lighting the dark houses will be discovered. The amount of coal on Willow Creek, on Spanish Coulee, on Sun River, on Missouri River and on Otter Creek can not even be conjectured from the small amount of work done at those localities. But enough is known to say these localities will furnish all needed supplies for domestic uses, and that Deep Creek, Sand Coulee and the Belt Creek mines can furnish an abundant supply for all manufacturing, mining and transportation purposes for the next century.

Value of Cascade Coals.—The Cascade coal mines are situated in the midst of a vast prairie country, which is rapidly filling up with a teeming and industrious population, whose homes must be warmed and lighted, whose factories, whose railroad trains, and whose machinery of all kinds must be propelled by coal. These mines are seventy miles from the nearest timber on the west, and three hundred miles from the nearest available timber on the north, six hundred miles from the nearest accessible bodies of timber in Minnesota, and with very little timber and none to spare even to the Gulf of Mexico on the south. And this in the midst of a building, manufacturing and mining population, and vast systems of railroads, which will soon exhaust all available supplies of timber and be wholly dependent upon our coal beds for fuel. And all this present and prospective growth of populations and industries is under the 47th parallel of north latitude, where we sometimes feel the frozen breath of the polar bear.

These mines, too, are near the junction of Sun River and the Missouri and Great Falls, the most beautiful and fertile region of the Northwest, and destined to become as populous as the valley of the Hudson.

Those who doubt our growth should study the history of Chicago and Denver. There are ten times the reasons why Great Falls should become a great city than there ever was why Denver should become the Queen City of Colorado. Montana is the greatest mining country in the world, and its mines are as yet scarcely prospected. Our agricultural resources are limited only by the amount of water, and that is increasing every year and will increase by natural laws as cultivation progresses.

The Cascade is the best and most available coal for the present and prospective demands of this growing region. These coals will play their full part in warming the million homes soon to adorn this whole region, in lighting and warming the cities of

the plains and the cities of the mountains, in running the machinery and in heating the furnaces of a thousand mines, and in running the trains of two great systems of transcontinental and meridian railroads. No coal, as we have shown, is better adapted to supply the varied wants of such a population. Its varied properties, its cheap mining and its available means of transportation, and the present and prospective demand, make this one of the most valuable coal regions of the Great West.

COAL OF LEWIS AND CLARK COUNTY.

Discoveries of coal have been made in several places on Sun River, some twelve miles above Fort Shaw; around the base of Haystack Butte, on the south fork of Sun River; on the north fork of Sun River; on Flat Creek; on the hills between Flat Creek and the Dearborn; near Eagle Rock; at and near Dearborn; in the mountains ten miles south of the Dearborn, and in a mountain valley near Mullan Tunnel.

The Sun River Coal above Fort Shaw has been worked a very little for local uses. It is a good coal, and proper development may prove it extensive as well as good in quality, and sufficient for all local demands.

Haystack Butte Coal Bed has been examined on Sun River, Willow Creek, Smith Creek, Beaver Creek, all tributaries of South Sun River. In all these places the coal is good in quality, but the quantity as yet proved up is not very great. It is used to supply local demands for such coal.

North Fork Coal.—A coal bed has been discovered on the north fork of Sun River, but I have not seen it, and cannot speak positively of its value.

Flat Creek Coal.—Two thin beds of most excellent coal have been opened on Flat Creek, below Hogan, and used for domestic and other local uses. How extensive these beds may prove is not yet determined.

Eagle Rock Coal Bed has been opened in several places on the Benton road near Eagle Rock and in that neighborhood. The bed is about six feet thick, and contains numerous shale or "bone partings." Some of the coal is very good, and is used in that region for domestic and other local purposes.

Dearborn Coal Beds have been opened on both sides of the river, just above the town. Cohn's mine is in the bluffs, on the north side of the river, and Embody's mine is in the hills, on the divide between the Dearborn and Flat Creek, four miles north of the river. Several mines have been opened south of the

river, all on the same coal *stratum*. This bed varies in thickness from five to seven feet. Some of the coal is very good; some is partly changed by the heat developed in throwing up the foot-hills in which it lies. This coal will doubtless be found nearer the main range of the mountains, and it may be so changed as to give us a workable anthracite.

Prickley Pear Coal Bed.—Another bed of coal has been discovered and worked in a valley some ten miles south of the Dearborn, in a valley of the Prickley Pear Mountains. This coal is abundant and good in quality.

Mullan Tunnel Coal Bed is in an Alpine valley just west of the Mullan Tunnel. The lower part of this coal bed is very similar to that at Sand Coulee, though not so good in quality. It has been worked and the coal shipped to Helena. This bed is high in the mountains and we would expect it to be changed to anthracite by the heat developed in forming the mountain. But when the mountain was elevated, this coal and the containing rocks were lifted bodily and kept on the surface where internal heat did not reach them in sufficient force to produce metamorphic rocks and change bituminous coal to anthracite. The bed is six or eight feet thick and about a half of it is very good.

This coal and the containing rocks formed a part of the horizontal surface strata before the mountains were pushed up through them. Hence we may expect that these same rocks and the coal bed in them still lie in the valleys on both sides of the mountains undisturbed. But, if there, they are covered deep beneath the Tertiary and Quaternary rocks deposited by the lakes that filled these valleys for many ages after the mountains were formed; and which were finally drained through the Gate of the Mountains on the east side and through Hell Gate on the west side.

The coals have not been much worked in any of these localities; but as the demand for such fuel increases, they will doubtless furnish a sufficient quantity of good coal of all common varieties to meet all local wants.

CHOTEAU COUNTY MINES.

Choteau County is in the midst of a vast prairie country, and is larger than a German principality or five New England States. It extends from the Rocky Mountains five and a half degrees east to the mouth of the Musselshell River, and from Lewis and Clarke, Cascade and Fergus counties on the south to the Dominion on the north.

Its prairie is unbroken save by the Little Rocky Mountains, Bear Paw Mountains, and Sweet Grass Hills.

As Choteau county has very little timber, most fortunately there are vast quantities of mineral coal in different parts of it. These coal beds already furnish an abundant supply of fuel for all local uses, and will eventually fill a large demand for exportation.

Birch Creek Coal Mines.—Two beds of good coal have been opened in the bluffs of Birch Creek, some six miles below the junction of Dupuyer Creek. The position of the rocks which contain these coal beds, and the lay of the land indicate that these beds underlie a large area of the adjacent country.

The upper bed shows 28 inches of a very pure bituminous coal, much like the best Rocky Fork coal. It contains numerous particles of mineral resin, burns freely, and gives good satisfaction for domestic uses and the smith's forge.

From 8 feet to 15 feet below the last bed is another, carrying about 4 feet of what appears to be a coal of medium quality; but it had not been sufficiently opened to enable one to determine with absolute certainty all its characteristics.

These coal beds dip slightly to the west and pass beneath the creek about a mile west of this locality, and may extend to the mountains thirty miles away, and to unknown distances north and south. The Birch Creek coal is on unsurveyed land just north of T. 30, N.R. 5 W.

Dry Fork Coal Mines.—South of the above locality, in T. 28 N. R. 5 W., coal appears in two places. One was under water in Dry Fork, and the other was covered with drift sands of the spring floods; but the coal was so like that coal of the upper bed on Birch Creek, that these croppings are probably on the same bed. As the country is higher than this coal bed on three sides and over a large area, it probably underlies a wide reach of the adjoining bench and bottom lands.

Muddy Creek Coal Mines.—What appears to be the same bed crops out again on the Muddy, north of Bynum's in T. 26 N. R. 6 W. Section 24. These croppings of coal, all apparently of the same bed as the upper one on Birch Creek, indicates that the whole country between the 112 and 113 deg. of west longitude from Greenwich and from the Marias to the Teton, is underlaid by the Birch Creek coal beds.

Milk River Coal Mines have been worked for several years to supply Fort Assiniboine and other local demands. I have not examined this coal field, but from what I can learn from

those best acquainted with it, the coal underlies a large area of country on the northwestern side of Bear-Paw Mountains and is practically inexhaustible. Some think it the same coal as that at Sand Coulee and Belt Creek.

There is a coal bed three miles north of Choteau in Gibbon's Coulee, probably the same as the upper bed on Birch Creek.

Another thin bed was seen in the foot-hills west and north of Choteau.

There are several coal beds at Coal Banks on the Missouri River. But many of the coal discoveries in Choteau county have not been sufficiently developed and tested to enable one to give an intelligent opinion of the quantity and quality of the coals contained in them; but enough is known to warrant the conclusion that every home and every city will find enough good fuel in these numerous beds to supply all their wants. More than half this country is covered by an enormous Indian Reservation in which there is no encouragement to the prospector to discover and develop mines, which may never yield him any reward for his skill and labor, however valuable the mine discovered and developed may prove.

The Lethbridge coal, so well known and highly esteemed for its good qualities, lies so near the northern boundary of Choteau, that we may expect it to extend into this county on lands now owned by the Indians.

It may be considered that nearly or all the western end of Choteau county is underlaid with good coal, suitable and sufficient for all local demands for fuel.

QUARTZ MINES OF CHOTEAU COUNTY.

Mines of Sweet Grass Hills.—For many years we have heard rumors of rich discoveries of placer and quartz veins in the Sweet Grass Hills away off on the borders of British America, where Piegan, Blackfeet and Big-Bellied Indians keep guard over mines and game. But the evidence is now conclusive that good placers and quartz mines have been discovered in this pleasant region "forever dedicated" to the use and profit of the indiginous Redman.

Many rich veins of gold, silver, copper, lead and iron have been discovered and partially opened. Placer mines have also been worked with varied results. When this country is opened and cheap transportation furnished, the Sweet Grass Hills will be the seat of a prosperous mining camp.

Mines of Bear-Paw Mountains.—All remember the famous stampede to the Bear-Paw mines in 1878, which ended in disappointment to many, and disaster to a few. Those who remained to prosecute the work of discovery and development, were driven away by the primitive landlords, who deemed this most like those “Celestial Hunting Grounds” promised to all “good Indians.” Placer and quartz deposits of great promise have been discovered at different times and sundry places in these mountains, sufficient to give strong hopes they will become the seat of active mining operations, when the white man can have legitimate claim to his discoveries.

Mines of Little Rocky Mountains have scarcely advanced beyond the stage of prospecting and discovery, still enough is known to show that these, like nearly all the mountain regions of Montana, are intersected with veins of the precious metals. Now, since these mountalns have been added to Uncle Sam’s dominion, we may expect to hear good things of the Little Rocky Mountains in the way of profitable mining.

IRON ORES OF MONTANA.

Iron Caps.—There is a vast amount of the brown hydrous oxide and sulphuret of iron forming the caps and constituting the gangues of thousands of our mines. Originally this iron was all sulphuret; but the combined action of air and water has changed this sulphuret from pyrites to limonite down as far as the air has been permitted to penetrate. Below permanent water the iron still remains a sulphuret.

Such iron caps are found in the mines of nearly every mining district in the State. While this iron is deemed a good indication (see p. 16) of valuable mines, and while it always has some gold and is a good flux for smelting richer refractory ores, it has but little value for manufacturing iron.

Bog Ores.—There are extensive beds of limonite in various valleys and ravines in our mining districts, which appear to have been deposited in water, as bog ores are. These beds were once covered with water, and the waters coming down from the mountain sides over and through the iron gangue and caps of the mines, became charged with that metal, which was deposited in the ravines below as bog ore. These iron ores usually contain small quantities of gold, which make them so much more valuable for fluxes. Some of this is pure enough to be worked as other bog ores are, in manufacturing iron. There are beds of these ores of great extent in the ravines in the Judith and Little Belt Mountains and other districts in the State.

Prospectors so often find the caps of mines of gold, silver, copper and lead made up of similar iron ore, that they have sometimes mistaken this bog ore for vein caps, and have worked through it to be disappointed by finding beneath barren rocks instead of metaliferous veins. A little examination of the position, shape and surroundings of these beds of bog ore will enable the prospector to distinguish them from the caps of veins.

Magnetic Iron.—Several deposits of magnetic iron, load-stone, have been discovered in the Judith Mountains, in large croppings from the head of Wolf Creek to the Barker District, and on Henderson Mountain.

Specular Iron has also been discovered in various parts of the State. There is an extended bed in the Judith Mountains, a strong vein in Red Mountain near Highland and extensive croppings of a vein of this ore in Fairview District in Jefferson county.

Spathic Iron has been noticed in many localities in the State in workable quantities. It often occurs in regular strata in the rocks with our coal beds and sometimes in concretions in shales and clays of the same age.

On Belt Creek a regular stratum of this ore crops out in the bluffs seventy-five feet below the great coal bed. This bed of spathic ore is twenty inches thick and has a uniform structure and thickness.

Three similar beds of spathic iron crop out for a long distance on the hills both north and south of Elk Creek, a tributary of South Sun River.

And still another bed south of Hogan, may be traced through Mamelles-de-fer and for some distance on the ridges to the south. These beds of spathic iron appear to be parallel to and form a regular stratum in the coal bearing rocks.

Black-Band Iron Ore appears in the croppings of a very large fissure vein cutting the Bear Creek coal field in a direction from northwest to southeast through sections 1, 6, 7 and 8. The vein varies in width from five to twenty feet and appears to be filled with black-band ore similar to that so much used in Wales.

This ore can be smelted by the raw coals so abundant in this locality by using a hot-blast furnace of proper construction.

Whether this ore is rich enough to be worked with profit by the cheap process above named, and whether it is pure enough to make good iron, can be determined by analyses.

Up to the present time in the history of Montana mining there has been but little demand for iron ores, save such as are

used in smelting for the gold they contain and their fluxing properties. But the day is not far distant when it will be more profitable to make our own iron. Then all ores suitable for that purpose will be more valuable and find a ready sale. The cost of transportation from the east will be a sufficient protection for manufacturing some varieties of iron for home consumption.

TIN MINES PROSPECTIVE.

In many of our placer mines considerable quantities of tin ore have been found in the sluice boxes. These particles of tin ore, like the particles of gold, evidently came from veins of that ore. Though none of it has as yet been found in veins or in the country rocks, there are strong reasons for the belief that deposits of tin ore will be discovered, but whether in sufficient quantities for profitable mining, cannot be predicted.

MINING, TIMBER AND WATER OF MONTANA.

Every one who has had the least experience in mining, will at once admit the absolute necessity of timber and water in successful mining. We have rich placers never worked, because no water could reach them without enormous expense. Hundreds and hundreds of mines made small yields last year, for want of the usual supply of water.

Give water enough to run giants in our placers, and millions in fine gold would be added to the annual yield of our mines. Give more water and the mines will give more gold.

Nearly all our mines have water enough, and some more than enough, in the early part of the season when the mountain snows are melting and the spring rains fill the streams. Could the surplus be saved till the dry season came, the efficient working time would be so prolonged as to double the yield of gold.

The General Government proposes to increase and prolong the supply of water for irrigating our farms by constructing large reservoirs and irrigating canals.

These modes of increasing and prolonging the supply of water, were resorted to by our enterprising miners at an early day in the history of Montana mining, as shown by the old reservoirs in nearly every gulch, and by the numerous ditches which once conducted the waters along the hillsides of every valley. But the mines are so numerous, and the amount of water for each is so limited, that this system of supply can avail to a limited extent only for increasing the water and for prolonging the mining season, save by an outlay of money beyond

the means of private individuals. It is different with irrigation, for large streams can be utilized, and the same canal can supply hundreds and even thousands of farms.

But nature has furnished the most efficient means of supplying our mines with both timber and water. Nearly all our mines are at or near our numerous mountain ranges, which nature has clothed with dense forests of pines. Nature has also provided that every tiny leaf of all these pines should constantly by night and by day, and in all seasons, give off moisture to be condensed into the clouds which yield the showers and snows of our mountains. And besides, nature has pushed these mountains high into the cold regions, so that every wind which comes from the warm Pacific freighted with moisture, is raised into these cold regions as it passes and its moisture is condensed into rain, hail or snow to fill our mountain reservoirs. Such are the provisions of nature to furnish the water needed by the mines in our mountains.

The effects of forests on the supply of water were especially noticeable during the last excessively dry season, while exploring the forest clad mountains of the Little Belt and Judith ranges and the vast forest region around Cook City. Instead of dry streams which everywhere else told of failing water and the early retreat of the miners from their placers and the herds of the stock men from their usual summer ranges, not seen in these forests regions, the springs and streams were full.

As we rode over these lofty mountains and along these deep valleys in the grateful shade of the "whispering pines," and noted everywhere the gushing fountains and the sparkling streams, we could but remember the ancient Chinese proverb:

"The largest rivers are cradled in the leaves of the mountain pines."

This is true in Asia, true in Africa, true in Europe and true in America. Wherever the mountain pines have been permitted to grow where the Great God planted them, the small fountains and the great rivers have continued to flow and make the lands fruitful. But where the axe has swept away these forests, the springs have dried up and the streams have left dry beds and the lands are covered with drifting sands, as is seen in Mesopotamia, Palestine, and northern Africa, once the most fertile regions of the world.

But how is it that these pine leaves feed the springs and mountain streams, and thus "cradle the mighty rivers," and keep them flowing through the driest seasons?

1st. It is well known that the leaves of the pines, as well as the leaves of all other living plants, constantly give off into

the air vapor of water. This vapor helps to form the clouds which so constantly appear on the mountains, and there furnish the frequent rains and snows so well known and ever expected in those high regions. These rains and snows help furnish the waters to keep up the springs and streams that feed the rivers.

2d. These pines shed large quantities of leaves and twigs and cones every year, which cover the ground and keep it moist and cool by preventing the evaporation of the moisture.

3d. This mulch of leaves and twigs and cones keeps the ground cool and moist and promotes the growth of mosses and lichens and grasses, which greatly increase the surface mulch, that like a thick carpet of sponges, holds the waters and gives them up gradually and keeps up the springs and small streams which make the mighty rivers.

This spongy coating varies in thickness from the fraction of an inch to several feet, as shown where fires have burned it up and exposed the logs and rocks it had covered.

4th. In these forests the snow falls in great quantities, and in spring the sun and warm winds melt it less rapidly in shade than in the open country; and the waters instead of running off and producing destructive floods as on our naked mountains, are absorbed by this spongy carpet and held as in reservoirs, which gradually yield them up to keep up the springs and streams through the long dry summer and autumn.

This is nature's reservoir, spread everywhere under the forests to catch the water of every mountain side and valley, and to hold it for the dry seasons to follow. And this reservoir, built by the Great Engineer of the universe, has no defects. Though built of tiny leaves, brittle twigs, flexible mosses, slender grasses and microscopic lichens, yet it is stronger than the walls of vast granite blocks tied and cemented by the rules of science. It never bursts and produces such floods as once carried ruin down the Ten-Mile and devastation and death to Johnstown.

In Florida and Louisiana it may be a pleasant sight to see the effects of the woodman's axe on the forests, and the planter's fires upon the jungle, letting the sunshine in upon the reeking soil; but in Montana the woodman's axe and forest fires destroy nature's reservoirs, and make our mountains and hills barren wastes and fruitful sources of ruinous floods; when the waters of melting snows and storms all sweep down to the valleys, leaving but little in the naked soil to supply the springs and streams. If one would see the difference, let him visit Cook City at the end of summer and feast his eyes with the glorious forests and the perennial fountains on every hillside and the sparkling streams

in every ravine and valley; and then go to Helena and see the mountains once clothed with grand old forests and native reservoirs; but now hideous with blackened stumps and naked rocks, dry sands and pebbly channels, where, before the axe destroyed our forests and natural reservoirs, springs gushed and streams flowed to quench the thirst of the miner and wash his golden sands. But now all Helena pants for Woolston's "bedrock water" from the swamps of the Ten Mile and Chessman's ditch.

But the natural reservoirs have been destroyed with the forests around Helena. Our engineers have done their best to fill their places with the artificial ponds their skill has invented. All can see how poorly these inventions supply the place of the natural reservoirs.

The whole world outside of America has learned the sad lesson that forests destroyed means disastrous floods, distressing droughts, failing fountains, dry streams and barren soils: as shown by the late floods from the Pyrenees in France, which swept away an ancient city; and the floods of China, which have devastated whole provinces, drowned hundreds of thousands, and left ten million people without homes and food and the means of support.

The nations built reservoirs as early as Solomon's time, which gave temporary relief; but their fountains have failed, and even Solomon's reservoirs are dry, and his fruitful fields and glorious gardens are now barren wastes.

But modern Europe has learned better. The woodman's axe is followed by the forester's spade. For every tree cut three new ones are planted.

Government help in building reservoirs will be a temporary aid to our miners and farmers; but while the Government undertakes to hold and manage our forests, something should be done to supply the destruction made by the wood-chopper, the lumberman, the coal-burner and the forest fires. As our forests disappear, our mining will languish.

Nowhere can forests be renewed and increased more easily than here. Young pines and firs by the million spring up in the wake of every fire and wood-chopper. A part of these young trees could be easily transplanted to unoccupied places in the mountains and foot-hills. Such a work would make the future of our mountain country more hopeful, and secure the working of our mines for the next thousand years.

But you say trees transplanted will die without water. So will the plants, which cover our mountains every springtime with their carpet of flowers, die without water. But these plants

utilize the waters as they drop from the melting snow. They spring up and bloom just below the snow line, and sometimes even through the snow. They follow the snow line as it melts and retreats up the mountain sides every spring, utilizing the water to feed their blooms and ripen their seeds.

The tree-planter might know as much as the violets and the anemone, and follow up the snow line and plant his trees where the ground is wet, under every log and beside every rock, where the moisture lingers latest.

By this following of the flowers, the tree-planter's season will last from March on the foot-hills till August in the high mountains. The anemone blooms all the way from March to July: March on the foot-hills, July on the Alpine summits.

Let us be wise according to our best lights. Let those who believe in God follow his plans for supplying the springs and rivers by forests; and those of us who believe in evolution follow the plan evolved by the laws of Nature to supply the waters needed in our homes, our factories, our mines and our farms.

And besides, this natural mode of keeping up the supply of water will also keep up the supply of timber so useful in mining. With the present system of destroying our forests, in fifty years our mountains will have but little timber; but trees planted now would be large enough for mining timbers in fifty years.

MINERS AND RAILROADS.

There are the strongest possible of all reasons why our miners and railroads should be on the most friendly terms; that they should exercise mutual confidence, forbearance and co-operation; for they are and must continue to be co-workers in prosecuting the greatest of all our industries. Fully half the business of our railroads depends directly or indirectly upon our mines, and the profitable working of most of our mines is equally dependent upon the cheap transportation of ores, fuel and bullion by our railroads. The morning journals have just announced that the largest mining plant in the world will stop operations, and throw thousands of miners out of employment at the beginning of a bleak winter, because a railroad cannot transport the necessary fuel. Whether this be correct or not, it reminds us of what might be the consequences of a lack of railroad co-operation with our mines. Many of our old-timers know well what Butte was before the railroads came; how Dr. Ford and others guarded well their "bright prospects"; and many have seen the Butte of to-day, but few comprehended its vast operations, the thousands of miners delving in its deep mines, the

endless trains of ores and fuel going to its mills and furnaces, and trains of bullion on their way to the markets of the world.

Red Lodge and Sand Coulee were nothing but buried coal-beds over which the buffalo and Indian had wandered, alike ignorant of their value, and the white man could make little use of them, till the railroads came. They are now, or soon will be, the greatest coal mines in the country. What Maiden and Barker and Castle and Niehart and Cooke City are to-day, Butte was before the railroads; and what Butte is to-day, Barker, Maiden, Niehart, Castle and Cooke City will be, with railroads to transport ores, fuel and bullion.

There are, therefore, the strongest possible reasons why the miners and the railroads should co-operate and maintain the most friendly relations.

The Pioneer Miners.—The original mining population of Montana like the men who opened the mines and built the towns of California and Colorado, belong to that pioneer race which has carried civilization and progress from the shores of the Atlantic to the Pacific seas. Before the unbroken front of this stupendous migration of brave men and lovely women, forests went down and sandy deserts grew green, blood thirsty brutes and more blood thirsty savages melted away. A thousand places gave up to these hardy pioneers their golden treasures with which they founded cities and built houses in lands fairer and brighter than any before seen.

This brought a rush of the most energetic and intelligent from our own country and afterwards from all nations, tribes and tongues on the face of the earth, who have filled our mines and mining camps with all that Cornwall, Clausthal, the Urals and Cordilleras ever knew of mining, and our towns with all that make such cities as St. Louis and Chicago.

When I visited Cook City, Maiden, Castle, Barker and Niehart, Red Lodge, Sand Coulee and Belt Creek during the present year, I found these mining camps occupied by prospectors and miners like those, I saw at Bannock, Virginia City, Sterling, Highland, Butte, Cable, Phillipsburg, Blackfoot, Montana City, Jefferson City, Helena, Trout Creek, Confederate Gulch, Eldorado Bar and Radersburg in the sixties. They belonged to the great pioneer army which opened the country from the Alleghanies to the Pacific.

Such are the men who have prospected our gulches and mountains, located and developed our mines, who built our quartz mills and furnaces, who made Montana the first mining state in the world, who covered our prairies with herds of fine horses

and fat beeves and flocks of fine wooled sheep. Such are the men who built our cities, who made our country and made railroads possible.

The Cooks, the Huntingdons, the Goulds and the Villards dream that they made the "New-Great-West," but their geographies told them this "New-Great-West" was a vast desert fit only for cayotes and buffaloes, roving Indians and a few trappers to grub a scanty living in. They never planned a railroad beyond the Missouri; they never dared use the vast subsidies of the government until these pioneers discovered the mines, built the mills and the furnaces and the cities of this mountain region and Pacific slopes. When the country was made they ventured to use those subsidies in building great trunk lines, and then by the help of some of those pioneers, who had made the country and made railroads necessary and profitable, such men as Hauser and Power, Broadwater and Hill, Clarke and Holter, they began to build railroads to aid in gathering up the nuggets and bullion, the fat beeves and fast horses and the woolly flocks from the great deserts of their geographies, and take them to eastern markets.

While railroads have greatly increased the wealth and prosperity of Butte, Helena, Philipsburg, Marysville, Sand Coulee and Red Lodge, and while Belt City, Neihart and Barker are inspired with new life by an approaching road, Maiden and Castle and Cooke City are still waiting for the whistle of the locomotive to fill them with hope and place them among the great mining camps of the world.

Cooke City would have had a railroad and been on the way to a great and wealthy camp had it not been for an opinion of a few based on facts purely sentimental and illusory that no locomotive should enter the sacred precincts of the National Park and wake up its sleepy denizens to the necessities of the surrounding country.

It is said that a line due east from Gardiner forms the northern boundary of the National Park. Some deny this and declare that the Yellowstone and Soda-Butte Creek are the legal northern boundary. Be this as it may, the powers that be declare the aforesaid imaginary line, stretching over mountains and across valleys to be the boundary, and soldiers are stationed to enforce it. But for all practical purposes, save to make trouble for the miner and the hunter, there might as well be no boundary; for no human being, neither miner, hunter, nor soldier, can tell where that line is, unless he carries a theodolite, a kit of mathematical and astronomical instruments and a book of logarithms, sines and cosines. When the miner makes a discovery he

cannot tell whether the sound of his pick will be heard in a state which will encourage his labor and secure him the benefits of his discoveries, or whether the first blow will bring to his side the soldier of a great Republic, who will drag him away to prison and to unknown fines and penalties.

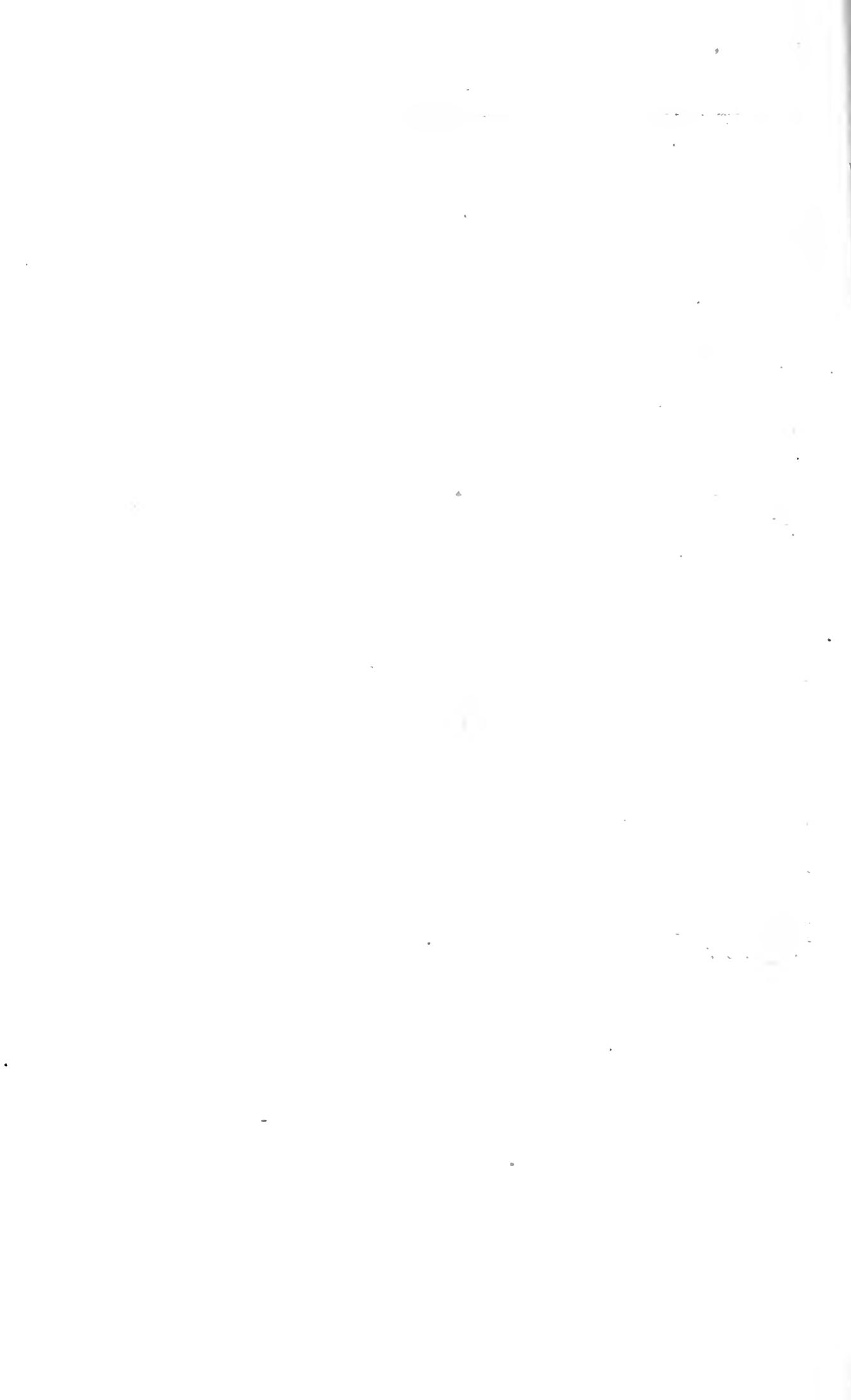
Should a bear or mountain lion or a skunk dispute his right to prospect in those wild regions filled with mineral veins, or a pheasant or deer tempt his appetite, he cannot tell whether the crack of his rifle will send harmless echoes through the mountains or make him a criminal in the land.

All well know there is not a single natural feature north of the Yellowstone and Soda-Butte Creek that is mentioned in the guide book as worthy of the tourists attention.

And besides the region between the imaginary boundary and the Yellowstone and Soda-Butte Creek, is essentially a mining region, and the mines on Crevice Mountain and in Crevice Gulch really come down so near the Yellowstone, that all the ground on the north side of that stream is needed for working them successfully.

In fact, there are many reasons why those streams should be made a part of the northern boundary, and none have been given why that boundary should be an imaginary line over such a mountain region that no one can know its position till it be marked by innumerable monuments.

A railroad on the natural route from Cinnabar to Cook City up the east side of the Yellowstone and Soda Butte Creek would add twenty dollars to the value of every one of the millions of tons of ore in the mines around Cook City. And this road would be built at once, should Congress grant the right up this natural route on the northern border of the National Park. Why not?



MINING IN OTHER COUNTIES.

Although the mines of Beaverhead, Madison, Jefferson, Lewis and Clarke, Silver Bow, Deer Lodge, Gallatin, Missoula and Dawson counties have not been fully examined for this report, it may be proper to give some general information in regard to each, since some of them are the most important mining counties in the State.

MINING IN BEAVERHEAD COUNTY.

This county was the theatre of some of the earliest and most hazardous mining operations in Montana. Not as hazardous on account of the uncertainties of mining products, as from the depredations of thieving Indians, and of the marauding and robbing road-agents, and the cost and risk of transportation. While the little band of pioneer miners were a thousand miles away from friends and the protecting arm of the Government, and under scant civil authorities improvised for temporary use, nearly all of which were in the hands of desperadoes combined with all the bad as against all honest workers and producers, these miners had a sharp struggle for life and food as well as for gold.

All old-timers feel a thrill of manly pride in that triumph of fearless and quick justice which made Montana mining possible, when they recall the wild and dangerous adventures that marked the early history of Bannock and the surrounding camps.

Nothing in history can surpass the cool courage and sturdy resolution with which these pioneer miners conquered and punished the thieving and scalping Indians, and the celerity and precision with which they captured a score or more of the murdering road-agents and their confederate official robbers, all combined to kill and steal, and the quick and unerring justice with which the guilty were executed or banished from the little camps in this vast wilderness. These adventures of our pioneer miners will ever form the most interesting and instructive chapter

in the wonderful history of the new mining States. Romancers can find no better field to show that the real events of history often surpass all the creations of the imagination, than the early history of Montana mining.

Before this necessary appeal to the first law of nature for the protection of life and property, no one was safe from the tomahawk and scalping-knife of the Indian, and from the pistol and bowie-knife of the road agent; but afterwards life and property were as safe in the wild regions of Montana as in any part of the civilized world. Few bolts and locks were used for many years.

Then all gave their energies to prospecting and mining. Placers were worked; and pan, rocker and sluice-box separated millions from the golden sands. Gold and silver veins were discovered; and the first silver furnace was erected at Argenta, from whose cupels great disks of silver were sent east at an expense nearly equaling the value of the silver, to astonish those who had furnished the money to erect this furnace. From the early sixties to the earliest nineties, mining has progressed with varied successes in this, the earliest mining county in Montana. And to-day, Beaverhead has a great number of productive mines, and one of the most valuable mining properties in the world, with reduction works at Glendale. Beaverhead has furnished millions for our country's wealth and prosperity, and will for centuries to come, continue to supply increased millions for the world's progressing business operations.

The following mills and furnaces are in Beaverhead county:

	Stamp Stacks	Kinds of Ore.	Capacity Per Diem
Heckla Reduction Works at Glendale.....		G. S. C. L.	250 tons
P. J. Kelly Furnace at Argenta.....	1 stack	G. S. L.	40 tons
St. Louis & Montana Furnace & Cupel at Argenta dismantled	2 stacks	Silver	20 tons
Bohm & Seligman smelter at Argenta.....	1 stack	Silver	40 tons
Gallagher & Clarke smelter at Argenta.....	1 stack	Silver	40 tons
Shenon mill at Bannock.....	15	Gold	30 tons
Connors mill at Bald Mountain.....	10	Gold	20 tons
Elk Horn mill at Elk Horn.....	5	Silver	10 tons
Hecla Concentrator at Hecla.....		S. C. L. F.	100 tons
Lone Pine mill at Dewey's Flat.....	20	Silver	40 tons
Hayes' mill at Dewey's Flat.....	2	Silver	4 tons
Divide mill on the Divide	20	Silver	40 tons
Dumhpy mill at Park.....			

MINING IN MADISON COUNTY.

Madison county had its full share in the stirring events which formed the early history of mining in Montana. The tide of migration which ever possessed the pioneer prospectors, and often developed into disastrous stampedes, flowed from Bannock to Alder Gulch, which soon yielded them the first plentiful installments of the \$137,000,000 in shining dust, which Alder Gulch has contributed to swell the tide of our country's prosperity.

Gold veins were soon discovered, and the unwonted rumble and thud and whistle of quartz mills were heard at Summit, Sterling and Silver Star; and Virginia gracefully wore the honors of the capital city of the mountain Territory. Mining in Madison county has steadily progressed, and her numerous mines are now yielding large returns, as shown by the following list of mills now pounding out the precious metals:

	Stacks.	Kinds of Ore.	Capacity Per Diem.
Brandon mill and concentrator at Brandon	20	Gold	50 tons
Elling mill near Red Bluff.....	10	Gold	15 tons
Noble Company's mill on Wisconsin Gulch.....	10	Gold	15 tons
Noble Company's mill on Wisconsin Gulch.....	5	Gold	10 tons
Ward mill at Sterling—an old-timer.....	10	Gold	15 tons
Clarke & Upson mill at Sterling.....	10	Gold	20 tons
Carter mill at Red Bluff.....	Carter	Gold	30 tons
New mill at Virginia City	15	Gold	30 tons
Ellis & Morris mill at Pony.....	20	Gold	30 tons
Carman mill at Pony.....	5	Gold	8 tons
Walter's mill on Boulder.....	10	Gold	15 tons
Broadway mill at Silver Star.....	20	Gold	40 tons
Green Campbell mill at Silver Star.....	10	Gold	15 tons
Sheridan mill at Sheridan.....	20	Gold	30 tons
Leiter & McCranor mill at Sheridan	10	Gold	15 tons
Baldwin mill on Brown's Gulch.....	10	Gold	15 tons
Meader mill on Hill Canyon	5	Gold	10 tons
Bradley Mill at Brandon	5	Gold	10 tons
Connor mill at Summit	15	Gold	30 tons
Old mill at Summit		Gold	20 tons
Roller mill, Kennett mine, at Virginia City.....		Gold	15 tons
Mueller mill at Rochester	15	Gold	30 tons
Marks mill at Silver Star.....	15	Gold	30 tons
Revenue mill at Richmond Flat.....	20	Gold	40 tons

MINING IN LEWIS AND CLARKE COUNTY.

Early in the annals of mining in Montana, the pioneer miners came prospecting to Last Chance, and were rewarded by rich deposits of gold in many of the gulches and bars in what is now Lewis and Clarke county. Many made fortunes in Last Chance, Dry Gulch, Oro Fino, Lump Gulch, Seven Mile, Green

Horn, Snow Shoe, French Bar, American Bar, Canyon Creek, Silver Creek and Scratch Gravel. Enriched and encouraged by the gold the glaciers had ground out and cached in the placers, the miners themselves undertook to grind out the treasures in the golden quartz of the Whitlatch Union, the Gloster, the Drum Lummon, the Empire, the Jay Gould, and a hundred other mines in the mountains of Lewis and Clarke. With the profits of these mines they have built Helena, constructed railroads, and extended a helping hand to develop the mining and the agricultural and the grazing resources of various parts of the State.

Many arastras, mills, furnaces, concentrators, and sampling works have been erected to aid in this work. Some have worn out, others have been removed, fire has consumed some, and the following still remain in Lewis and Clarke:

	Stamps Stacks.	Kind of Ore.	Capacity per D'm.
Drum Lummon Mills, at Marysville.....	120	Gold	280 tons
Helena Reduction Works, at East Helena.....	3 Stacks	G. & L.	250 tons
Jay Gould Mill, at Stemple.....	10	Gold	30 tons
Empire Mill, at Empire.....	60	Gold	250 tons
Gloster Mill, at Gloster.....	60	Gold	250 tons
Belmont Mill, at Belmont.....	10	Gold	15 tons
Whitlatch Mill, at Unionville—old	30	Gold	40 tons
Schaffer Mill, on Oro Fino.....	5	Gold	8 tons
Wainscot Mill, on Dry Gulch.....	10	Gold	30 tons
O'Rear Mill, on Dry Gulch.....	5	Gold	10 tons
Homestake Mill, in Stemple	5	Gold	8 tons
Hubbard Mill, in Stemple.....	10	Gold	12 tons
Hickey & Crocker Mill, on Sugar Creek.....	10	Gold	15 tons
Constant Mill, on Lump Gulch.....	10	Gold	15 tons
Colliston Mill, in Helena District.....		Gold	10 tons
R. E. Lee Concentrator, at Rimini		S. G. L.	30 tons
Esler Concentration, at Helena.....		G.S.L.C.	100 tons
U. S. Public Sampling Works, at Helena.....		G.S.C.L.	50 tons
Montana Sampling Works, at Helena—burned		G.S.C.I.	300 tons
The Helena Sampling Works, at East Helena.....			
Constance Mill, on Nelson Gulch	10	Gold	15 tons
Harvey Mill, at Park City.....	20	Gold	30 tons
Columbia Company's Mill, at Unionville	25	Gold	50 tons

MINING IN JEFFERSON COUNTY.

In mining, Jefferson county came as close upon the heels of Madison, as Madison did upon the steps of Jefferson in the Presidential succession. Montana City, Jefferson City, Boulder, Gregory and Radersburg were prosperous mining camps in the early sixties. To-day, Wickes, Corbin, Elk-Horn, Gregory, Basin, Cataract, Radersburg, St. Louis, Indian Creek, Boulder, Beaver Creek and many other mining camps are keeping up the

reputation of Jefferson as a rich mining county. Many scores of good mines are giving up their precious metals to increase the treasures of the world.

The following mills and furnaces are working the ores in Jefferson county:

	Stacks Stacks.	Kind of Ore.	Capacity per Diem.
Elk-Horn Mill, at Elk-Horn.....	30	Cold	60 tons
Iron Age Mill, on Beaver Creek.....	10	Gold	15 tons
Keeting Mill, near Radersburg.....	20	Gold	30 tons
Elk-Horn Furnace, at Elk-Horn.....	1 Stack	G. S. L.	30 tons
Wickes Reduction Works, at Wickes.....	3 Stacks	G. S. L.	125 tons
Gregory Smelter, at Gregory.....	1 Stack	G. S. L.	
Amazon Smelter, in Boulder Valley.....	1 Stack	G. S. L.	30 tons
Corbin Concentrator, at Corbin.....		G. S. L.	130 tons
Comet Concentrator, at Comet ?).....		G.S.C.L.	150 tons
Bonanza Chief Mill, near Montana City.....	10	Gold	20 tons
Concentrator, on Cataract.....		G. S. L.	15 tons
Arastra, on Keeting Gulch.....		Gold	2½ tons
Arastra, on Keeting Gulch.....		Gold	2½ tons
Smith Mill, on Indian Creek.....	20	Gold	30 tons
Jewell & Sage Mill, on McLellan.....	20	Gold	20 tons
Dumphry Mill, in Park District.....	20	Gold	40 tons
Emanuel Mill, in Park District.....	5	Gold	8 tons

MINING IN DEER LODGE COUNTY

Has had a full share in making up the history of Montana mining. The first gold discoveries in the State were made on Gold Creek in this county by an enterprising trapper. Gold Creek, Little Blackfoot, Washington Gulch, McClellan Gulch, Nevada Creek, and Pioneer were prominent mining camps in the early days. These and numerous others are still yielding up their deposits of gold.

Deer Lodge had the first good silver mill in the State, at Phillipsburg, and now has the most productive silver mine in the world at Granite Mountain, and the most extensive reduction works in the world at Anaconda.

The following mills and furnaces are now working out the precious metals in Deer Lodge:

	Stacks.	Kinds of Ore.	Capacity per Diem.
Anaconda Reduction Works, at Anaconda—14 steam stamps, 105 roasting furnaces and 68 matting furnaces.	14 Stamps 173 Stacks	S.G.C.L	2,000 tons
Granite Mountain Mill, at Granite	20	Silve:	40 tons
Rumsey Mill, at Granite	50	Silver	100 tons
Hope Mill, at Phillipsburg	10	Silver	20 tons
Black Pine Mill, at Black Pine	10	Silver	20 tons
Cable Mill, at Cable	20	Gold	30 tons
Algonquin Mill, Trout Mine, near Phillipsburg	20	G. S. C.	40 tons
Northwestern Mill, at Phillipsburg	15	Silver	30 tons
Champion Mill, at Deer Lodge	20	Silver	40 tons
Red Lion Mill, above Georgetown	5	Gold	10 tons
Pyrenees Mill, at Georgetown	10	Gold	20 tons
Salton Cameron Mill, at Georgetown	10	Gold	20 tons
Lehman & Lewis Mill, at Little Blackfoot	Pans	Gold	12 tons
Michigan Mill, at Washington Gulch	10	Gold	20 tons
Leiser Mill, at Lincoln Gulch	10	Gold	20 tons
Huntington Mill, at Harvey Creek	Roller	Gold	15 tons
Penobscot Mill, at Penobscot	10	Gold	20 tons
Ball Butte Mill, at Ball Butte	10	Gold	15 tons
Dr. Brooke Mill, at Ball Butte	5	Gold	8 tons

MINING IN SILVER BOW COUNTY.

Silver Bow County was early in the field to bestow golden rewards upon the pioneer prospectors. While the placers of Butte and Silver Bow yielded large quantities of gold and silver dust, the Highland placers gave the finest gold found on the continent. Those who discovered the rich copper, gold and silver veins of Butte, waited long between the decline of the placer mining and the prosperous quartz mining, which has made Butte the foremost mining camp in the world.

Mr. Travarthen gives an account of the Silver Bow mines and mining in his report.

CASCADE COUNTY FURNACES.

	Stacks.	Kind of Ore.	Capacity per diem.
Great Falls Reduction Works at Great Falls	4 Stacks	G. S. L.	250 tons
Boston & Montana Reduction Works to be at Great Falls.		G. S. L.	1000 tons
Silver Bell Furnace at Glendennin	1 Stack	G. S. L.	40 tons
Old Furnace at Hughesville—defective	1 Stack	G. S. L.	10 tons

MEAGHER COUNTY MILLS AND FURNACES.

	Stacks Stacks.	Kind of Ore.	Capacity per diem.
Castle Furnace at Castle	1 Stack	G. S. L.	35 tons
Toston Furnace at Toston	1 Stack	G. S. L.	50 tons
Little Dandy Mill on Trout Creek.....	10	Gold	20 tons
New York Mill on Trout Creek.....	10	Gold	15 tons
Philadelphia Mill at Diamond	10	Gold	15 tons

PARK COUNTY FURNACES AND ARASTRAS.

	Stacks Stacks.	Kind of Ore.	Capacity per diem.
Republic Smelter at Cook City.....	1 Stack	G. S. L.	35 tons
E. M. M. & S. Co.'s smelter at Cook City.....	1 Stack	G. S. L.	20 tons
Portable smelter on Miller Mountain—not good.....	1 Stack	G. S. L.	5 tons
Nye City smelter at Nye City.....	1 Stack	G. S. L.	40 tons
Jo Brown astra on Bear Creek.....	1 Tub	Gold	1½ tons

FERGUS COUNTY MILLS AND FURNACES.

	Stacks Stacks.	Kind of Ore.	Capacity per diem.
Maiden Mill at Maiden	10	Gold	20 tons
Spotted Horse Mill at Spotted Horse	10	Gold	20 tons
Gardiner Mill at Yogo.....	.	Gold	15 tons
Shelby Astra at Yogo	2 Tubs	Gold	2 tons
Reverberatory Furnace at Neihart	1 Stack	G. L. C. L.	5 tons
Neihart Furnace at Neihart.....	1 Stack	G. S. L.	50 tons
Old Concentrator at Neihart		G. S. L.	20 tons
Fort Scott (?) Concentrator at Neihart.....		G. S. L.	40 tons

MINING IN MISSOULA COUNTY.

Hitherto Missoula County has stood at the head with her golden faults and vast area of timber lands, and in sharp competition with Gallatin, with her wonderful garden and farm products, to furnish the needed food, fuel and lumber for the mining Counties of the State. But now Missouli is coming forward with extensive coal fields and many quartz mines, which promise to rival the richest in the country. Why not?

Missoula has long ranges of metalliferous mountains on each side of her large territory, and large areas of her rich soils are underlaid with coal-bearing rocks. The groups of quartz veins at Pardee, on Hall Creek, and in several localities on each

side of Bitter Root Valley are now attracting the attention of capitalists. There are many reasons why Missoula should add many rich mines to her agricultural and forest resources.

MINING IN DAWSON COUNTY.

It may appear premature to some to speak of the mines of Dawson county; but the geology of the county gives us reason to expect good mining properties in its limits.

So far as known to the writer, who examined some portions of the geology of this county in 1867 and 1868, there is no reason to expect any mines of the precious metals in Dawson; but there is good reason to expect the discovery of coal beds to supply this vast prairie country with all needed fuel.

A considerable portion of the county is underlaid with the coal bearing strata, and it is surrounded with good coal fields. On the east we have the extensive coal fields of North Dakota, on the south the coal fields of Custer county, and on the west the coal fields of Fergus and Choteau counties. There is therefore very good reason to expect an abundance of coal in Dawson county.

THE TIME TO WRITE THE HISTORY OF MONTANA MINING.

It is said, we can expect no true history of a period until those who made that history have passed away and others, who knew nothing of the facts, came to make up the record; but in mining the case is different, the men who made that history are deemed the best authority for the facts of that history. Since therefore those pioneer miners, who made the early history of Montana mining, are passing away, the early history of Montana mining should be written at once.

DEPUTY'S REPORT.

Dr. G. C. Swallow, Inspector of Mines:

DEAR SIR:—I have the honor to transmit to you my report of the mines of Butte and neighborhood, and the Wickes mines, which it has been my pleasure to examine during the past six months:

BUTTE.

Without a shadow of doubt, Butte is the largest mining camp on earth. The State of Michigan can boast of its Calumet and Hecla copper mines, and a few others in the same neighborhood, which support the town of Red Jacket. Nevada has its Comstock mines, and thousands of miners from all parts of America went to Virginia City from 1870 to 1875 to share in the riches of the great discoveries. Leadville, Colorado, once in its history made many a miner anxious to move there; but her days of richness were of short duration, and to-day we scarcely hear much about it.

Marysville has its Drum Lummon, Phillipsburg its Granite Mountain, and every other mining camp in Montana has its noted mines; but Butte has scores of large mines that have no equal in any other part of the world.

On every side of the town, and even in the midst of the city, miners are at work, and while the peaceful citizens are slumbering in their homes, the ore is being dug out of the mines beneath those homes by the sturdy miners of Butte.

The residents of Butte are interested in beautifying their places of abode, equal to most of our cities, for they are satisfied that all improvements made are bound to be good and paying investments.

THE SMELTERS.

Nearly every mining company has its own reduction works close to the mines. South of the city smelters are at work for miles in length, covering a large portion of the Silver Bow Valley. The largest of these are owned by Col-

orado, Butte, Parrot, Butte and Boston, and Boston and Montana Mining and Reduction Companies. North of Butte and Centerville are several large smelters owned by Lexington, Alice, and Moulton Mining Companies, and wherever a person moves in the neighborhood, smoke and steam can be seen at the shaft houses and smelters on every peak and in every canyon. This is a guarantee that a great amount of work is going on beneath the surface. Scarcely a train moves out of the town but what thousands of dollars of bullion are shipped out by the express companies, which assists to make men of all classes increase in wealth. The greatest inconvenience experienced in the neighborhood is the smoke arising from the different smelters, and during the cold winter days the air seems much heavier than smoke, and settles down on the smoke and prevents it from escaping into mid air. Sometimes the smoke is so dense that persons walking the streets can scarcely imagine an object the width of the street; but when the springtime comes the smoke disperses, and for about nine months during the year Butte is a very pleasant place to reside at. The smoke also prevents the growth of vegetation, but occasionally with very great care and plenty of irrigating a few trees manage to retain life. Hundreds of the mines are too small to have reduction works of their own, and most of the ore taken out by small companies and prospectors is reduced at the smelters south of the city.

RAILROADS AND MOTORS.

Some years ago Butte was without a railroad and all merchandise brought to Butte had to be hauled by mule teams and oxen. After the Union and Central Pacific tracks were laid over the plains which connected the East and West to a through and direct route by rail, it shortened the journey of the overland coaches and made transportation somewhat cheaper to Montana. Shortly after these roads were in operation the Union Pacific took advantage of building their road North to Pocatello and later on to Dillon.

They soon realized that Butte was to become a great mining camp and concluded to lay a narrow gauge track to Butte via Silver Bow, which brought merchandise and every other necessary to Butte at very much smaller freight rates and soon an ambitious crowd of miners from all over the world began flowing into Montana, most of them directed to Butte to join in swelling the number of inhabitants, and increasing the wealth of this promising camp, and to-day it is estimated that the population of Butte has increased to about 30,000 souls, and at least one fifth of this number are developing the mines and prospecting for others.

This number includes Walkerville, Centerville and Meaderville, all of which are actually joining the city.

In the year 1883 the Northern Pacific Railroad Company laid their track from St. Paul through to Montana, passing the Utah & Northern within a few miles at Garrison, and then the Utah & Northern soon removed their narrow gauge track from Pocatello and laid a wide gauge to Garrison connecting with the Northern Pacific at that point, thus connecting the towns of Montana east and west of the Rocky Mountains, and instead of taking fifteen hours to reach Helena from Butte by the Gilmer & Salisbury coach, the distance is now made in about two hours and forty-five minutes. In 1887 the Montana Central commenced to lay their track to Butte and was completed in 1888, and now runs two daily trains in and out of Butte. The Northern Pacific and Union Pacific also runs a daily train between Helena and Butte (jointly), known as the Montana Union, thereby making a competition in all kinds of traffic. These roads branches out into different parts of the State, from which they bring in the products of the State to sustain those who dig beneath the surface for the precious metal.

Motor lines and cables are laid through the principal streets of Butte, also running to Centerville, Walkerville and Meaderville. The street cars meet all railroad trains and has its line extended to the Fair Grounds and the Zoological Gardens, three miles distance, which is a great convenience to the public.

During the summer months pleasure parties meet at the garden, and the Miners' Union hold their annual picnics at those grounds, where the miners of all the mines join in a day of recreation.

WEALTH OF THE RESIDENTS.

It cannot be doubted but what more money is being circulated among all classes of men in Butte than any other camp known. About 5,000 men are employed in the mines of Silver Bow county at an average compensation of \$3.50 per day, making a daily circulation of about \$17,500, and which foots up to \$525,000 per month to the miners only; and against millmen, etc., are paid, the total sum will reach at least \$750,000. This is without doubt the largest sum of money paid to the laboring men of any one mining camp on earth.

The capitalists do not fail to receive their just reward for their outlay, and hundreds of men who came to Butte poor are to-day in exceedingly good circumstances, while some of them are millionaires.

These prosperous miners have made Butte their home. Instead of seeking "green fields" far away, they have erected beautiful homes in the city, and are satisfied that the best place to invest is at home, where they made their money.

Families and single persons are emigrating to Butte from all parts of the civilized world, and it is estimated that a year or two from now no less than 50,000 people will be rustling in Silver Bow county for a share of the riches of the great camp.

THE MINES.

The Anaconda Mining Company owns and works the largest mines in Montana, including the Anaconda, St. Lawrence, Mountain Consolidated, Green Mountain, Wake-up-Jim, Modoc, Matte, and Orphan Boy. They are also owners of several mines in and around Butte, most of which are doing little work.

The Anaconda is acknowledged to be the largest of those mines. It is situated northeast of the city, and overlooks the city and the large Silver Bow Valley where the smoke of the smelters fills the air. This is most certainly the largest copper mine in the known world, and worked upon the most improved system of mining. The Calumet and Hecla of Michigan, with their six or seven shafts stretching from Osceola to Schoolcraft, with their conglomerate and other belts of copper, are large producers; but the Anaconda is much larger, and a greater producer than any mine in Michigan at per foot of the vein in length. Ten years have elapsed since much work was first done on this property, and now the shaft is sunk to the 1,000 foot level with better indications than ever before presented, and the youngest child in Butte is apt to be mouldering in the dust when the riches of this mine continue to be good. Three hundred and fifty men are employed in this mine taking out the ore, which is the largest force of men in any mine west of the Rocky Mountains, and probably second to none in the United States. It requires about \$40,000 per month to pay the laborers of this mine alone.

About 900 tons of ore per day can be got out of the mine, if needed; but owing to the many mines at work by the company and the amount of ore taken out of them, it is not required. The ore is shipped to Anaconda, a distance of 25 miles, by the Montana Union Railroad, for reduction. The Montana Union has a road graded from the depot to the different mines, *via* Meaderville, which required several miles of grading at a great cost. This road also is used for hauling fuel, timber, etc., to the different mines, and everything used at the mines is laid down in convenient places for use at the different mines of the company.

Since the burning of the smelter at Anaconda, the returns from all of their mines have been decreased; but when the new smelters are ready to work, the probabilities are that 3,500 tons of ore can be shipped daily. The mines are worked upon the safest system possible, and every possible precaution taken to prevent accidents, and after being well timbered, every slope is being filled with waste dirt. The mines are lit up with the electric light at the station and also on top, which is a safe plan for a mine filled as those are with timbers.

A large Knowles pump is at work on the 1,000 foot station, which forces the water to the surface. Usually the Knowles are used to force water about 300 feet, and with so many pumps in a mine it requires much steam to work them; but this large pump saves the expense of others, and naturally makes the shaft more cold. At the 300 and 400 stopes the air was exceedingly hot, which makes it inconvenient and undesirable for miners to work in. I am convinced that the stopes could be made as cold as any in Montana, which would be of more benefit to the company than to the employes; for no living man could possibly descend that mine in those hot stopes and do more than half of an ordinary day's work without doing an injustice to himself, and naturally wastes away. I called the Superintendent's attention to the matter with the suggestion to cool it off, and am satisfied that the health of the employes could be verily benefited by adopting the methods laid down.

Some men will sometimes estimate the value of the companies property at Butte, but it is almost impossible to do so, when the mines are even richer at the bottom than ever before. One third of the employes are engaged in doing "dead work" to secure the mine as the ore is taken out.

The returns of the Anaconda company has been greatly retarded, during the past year, owing first to the cave in the St. Lawrence mine, when it caved from the 500-foot level almost to the surface, and fortunately only one man was killed. Then came the fire at the smelter, and it was rumored that the mines could not work for two years, and for a short time operations ceased, but commenced again shortly with a smaller force of men, while some of their mines remained idle till about one month ago. Then comes the fire at the St. Lawrence mine, which caused the entire suspension of the St. Lawrence and Anaconda, and for fully one month the mine has been sealed up, the account of which I will mention further on in my report.

ST. LAWRENCE.

The St. Lawrence mine is adjoining the Anaconda and on the same vein of ore. They are connected at most of their tunnels, but owing to the St. Lawrence being 200 feet lower at the

surface than the Anaconda, such differences are made in their levels as they go down.

Sinking commenced at the St. Lawrence in the month of October, 1882, and since that time the shaft has been sunk 800 feet beneath the surface and nearly reached the 900 since I visited it. After reaching the 800 foot level sinking was suspended for awhile, owing to the immense quantities of ore opened up, sufficient to run the mine for many years to come. This mine employs 250 men, and when the shaft is not being sunk fully 800 tons of ore can be brought to the surface daily; but when sinking is resumed the output is reduced, as one shaft has to be used entirely for sinking purposes. This mine and the Anaconda uses "60,000" feet of lumber per day to secure the mines with. No expense is spared to secure the mine. This is one of the heaviest ground mines in Butte, owing it is presumed to the great cave during the early part of the year. Timbers alone would be valueless in this mine, and it would be cheaper to put a company of men at work at the surface digging out the mountain to fill up the mine than use solid timbering. The heat exists here similar to the Anaconda mine, and with openings to the surface direct to the hot stopes I am satisfied would make the mine more convenient and comfortable to work in, and the expense would be very little indeed. One thing I discovered in this mine was that the miners were in the habit of getting on a cage with two full carloads of dirt and riding to the surface, which is a dangerous system and one that should not be tolerated by no company on earth. It sometimes happen that cages are busy and it would be an inconvenience to give up the use of the cages for men to ride on, but should some one receive fatal injuries in that direction there are some steps generally taken to prevent further accidents; but the proper time to commence to suppress such acts is before some one falls a victim to the hand of death, or our streets lined with a funeral procession.

MOUNTAIN CONSOLIDATED.

The Mountain Consolidated is situated east of Centerville and has been at work for about three years. During the three years it has worked an immense quantity of ground has been opened up. A three compartment shaft has been sunk to the 550 level and six tunnels run on the vein. Three hundred and fifty men are engaged at this mine, and some days so much as "900" tons of ore taken to the surface. About forty feet below the surface is a tunnel driven to connect with the shaft from the side of the mountain, and a track laid to an ore chute which will probably hold 3,000 tons of ore. The ore is dumped in this ore chute and then taken to Anaconda for reduction. "About

thirty-five men are employed in this mine, who do nothing but put in timbers, and that number is assisted by the miners themselves." There is no doubt but what this is one of the largest copper and silver mines in America, and will be a permanent mine for at least a quarter of a century.

Any amount of timbers of all lengths are at this mine (and the other mines of the company) ready for use, and any employe discovering any existing danger is bound to remedy it at once, or discharged for failing to do so.

HIGH ORE.

The High Ore is situated east of Wake-up-Jim and west of Speculator mines, and also worked by the Anaconda Company. Operations commenced on this mine about three years ago, but owing to the Anaconda smelter burning, work was suspended, but opened up again a short time since, and now has a force of 120 men at work. This mine is on the same vein as Mountain Con., Green Mountain and Wake-up-Jim, being the farthest east of the number. The mine promises to be one of the richest ever opened up in Butte, and is a well developed mine.

WAKE-UP-JIM.

The Wake-up-Jim, or more frequently known as the Jim, is directly west of High Ore and east of Green Mountain. This mine, like the rest of the Syndicate mines, was closed down when the smelter was burned down, and has not opened up since. When the shaft was first sunk it was only a two compartment, and with one being used for a pump shaft the other was not enough to work the mine to any advantage, and during the temporary suspension another compartment was being added, so that when they resumed work two cages could be used, and a large crowd of men engaged to dig out the ore. The Jim is one of the safest mines in the district, and is a well developed mine.

GREEN MOUNTAIN.

The Green Mountain is situated between the Jim and Mountain Consolidated.

This mine was opened about the same time as the rest of the "Chambers Syndicate" by the Anaconda Company, and sunk the shaft to a depth of 400 feet, and will soon complete the sinking to the 500 foot level. Outside of sinking, no other work was being done, except closing up tunnels, etc., and getting

ready for work when the smelter is ready. The foreman passes through these mines twice each week to keep them properly attended to during suspension, and should anything need repairs, it is done immediately.

MODOC.

The Modoc is east of Speculator, and west of Meaderville and the Colusa mines.

This is also idle during the repairs to the smelter, and is only sinking and drifting so as to open up ground for future developments.

The shaft is sunk to the 300 foot level, and has ground enough laid open for work, and it is anticipated that fully 100 men would be employed soon. Eighteen men were employed sinking a three compartment shaft to the 400 foot level. The ore is of very high grade, and so soon as it commences to work again it will increase the returns of the Anaconda Company very materially by returning at least 150 tons of ore daily.

BELLE.

The Belle is a small mine adjoining the High Ore on the west, and connects with the High Ore at several levels. Scarcely any work is being done, and they did not intend to work any till the completion of the smelter. These mines are known as the Chambers Syndicate, and cover a space of ground about one mile and a half long by 600 feet wide. Five of the largest in the district are on this large vein, and the past summer has been one of absolute quietness on this belt, except the Mountain Consolidated. The suspension of labor on these mines alone has retarded the output of the Anaconda Company several millions of dollars, and prevented thousands of dollars from being circulated among the workingmen of Butte and Anaconda, which is felt by business men and miners alike; for if the mines of Butte failed to yield those enormous quantities of ore, the business men would soon have to move to other fields of labor in search of homes and business.

Joseph Laird, who superintends the Syndicate under Michael Carroll, passes through those mines daily, the same as if they were in constant operation, to see that everything is kept perfectly secure, and ready to commence taking out ore at any moment.

Ore chutes are built at nearly every mine, when the Montana Union cars take the ore from the chute, and instead of

hauling out a few tons, the same as is done from other mines at one time, the trains move out with about 250 tons.

ORPHAN BOY.

The Orphan Boy is situated west of the city about two miles, and about midway between Butte and the town of Burlington. This is another of the Anaconda mines that has failed to extract any ores during the summer, owing to the fires at the smelter. The shaft was being sunk, and drifts running at the different levels, opening a large body of ore which can be taken out cheap when work is commenced on it.

The ore taken from this mine is unlike the ores from the other mines of the company, and is about the only body of Galena ore in the neighborhood. At present the body of ore is standing from the 100 foot level to the 500 foot level untouched, except drifts run on it, and when a full force of men are put to work a large quantity of ore can be sent to the smelter daily. The deeper the mine has been sunk, the wider the vein has opened out, until it has reached about 35 feet in width; and every hundred feet in depth opens up a body of ore capable of running the mine for many years. Only sixteen men were at work in the mine, while several were prospecting on top for other veins.

The Orphan Girl adjoins this mine and belongs to the same company, but is not worked. Several industrious prospectors are at work in the neighborhood who are doing well, and it will only require a few months of toil and the advancement of a little capital to start up several mines which will add to the wealth of Butte and employ a great number of men.

The ore from the Orphan Boy is not shipped at present to Anaconda, but hauled with teams to the Parrot smelter, south of Butte.

MATTE.

The Matte is situated north of Meaderville and close to the track of the Montana Central railroad. In reaching Butte by this railroad the Matte is the first mine reached in Silver Bow county that is being developed and is one of the richest mines in the county. The ore is rich with copper and silver, but the vein is much smaller than most of our copper veins. The Matte has not worked much during the summer, but started up recently with a force of sixty men, and with this force of men about eighty tons of ore is sent to Anaconda daily. These returns can

be increased materially when the smelter runs at a full capacity, and many more men can find employment here.

The Anaconda company has a great many unworked claims in this neighborhood, and it was thought at the time of the fire in the St. Lawrence and Anaconda mines that work would be commenced on all these properties to keep up the regular output.

BUTTE & BOSTON MINING COMPANY.

The Butte & Boston Mining Company has not existed long in Butte, but when they thought of doing anything in the neighborhood it was with the intention of finding out what was beneath the surface and commenced to purchase property where they could find it for sale at any reasonable figure, until they became the owners of the Silver Bow, East & West Gray Rocks, Belle of Butte, La Platte, and many other smaller properties in the district.

SILVER BOW.

The Silver Bow mine is situated east of Harris and Lloyd and is about midway from Butte to Meaderville. The mine derived its name from the county in which it is located, but while so many prosperous mines are now worked in Silver Bow county no district is looked upon with greater interest than the Silver Bow mining district. Little or no interest was taken in this district till about two years ago, although close to the St. Lawrence mine; but the Butte & Boston Company sent Superintendent C. H. Palmer and other prominent mining superintendents to examine the properties, and after three weeks of very careful examination concluded that a purchase of the property would be a good investment, which has proved to be true. The Silver Bow extends several miles across the Silver Bow valley, and every person acquainted with mining in Butte are satisfied that it will turn out to be the richest mines ever seen this side of the Rocky Mountains, and no man is more sanguine than the superintendent himself. Soon after a purchase was made a three compartment shaft was sunk to the 400 foot level and crosscuts driven at the different levels to the vein. When the vein was struck all anticipations were excelled and a large rich vein was struck at every level from the 100 foot level down to the 400 foot level.

The greatest disadvantage to the company was the great amount of water encountered, and it was reasonable to expect that such would be the case as the shaft at about the 100 foot level was as low down as the valley itself, and as a natural consequence the water from the valley would flow into the mine.

The water was not enough to require any very large pumping machinery and it was easily handled by one of the Knowles pumps. Every hope is entertained that these discoveries will be a boom to Butte and ere long many mines will be opened up in the valley south of the present shaft, and if the veins turns out as expected, it will make a large town out upon the open flat.

The mine is timbered upon the same principal as the Parrot, as the foreman (Joseph Henworth) left the Parrot to take charge of the mine and adopted the Parrot system, which is not excelled in Montana. The cages used was far from acceptable to any employe, having been used without bonnets or safety appliances. Such trifling things as these are too often neglected by mining companies, until a rope breaks and men are killed, or something goes down a shaft, when a bonnet may protect life. In case an accident of these kinds occur and a jury should blame a foreman, superintendent or company for neglect of such lawful duties so as to make them criminals before a court of justice, this would not restore life, nor bring comfort to the comfortless, nor bread to widows and orphans who had been deprived of their main support. A mill has been erected southeast of the shaft house and all the ore taken from the mine placed in the mill without further handling.

Since my visit new cages have been put in the shaft, which gives satisfaction, and a new shaft being sunk for ventilation and egress.

BELLE OF BUTTE.

The Belle of Butte is located almost in the center of the town of Walkerville, south of the Alice and Clark's Fraction mines.

The mine was formerly owned by A. J. Davies, of Butte, who, after spending considerable money to develop the mine, closed down without any material success.

Soon after, John and Frank Doyle leased the mine for two years, during which time they did exceedingly well. When the lease expired, the mine was offered for sale, and a purchase made by the Butte & Boston Mining Company. Work soon commenced under the directions of the new company, and the mine has since continued to produce large quantities of silver ore, which is shipped to the Silver Bow mills for reduction.

Thirty-two men are employed working in the slopes and drifts of the mine, and it is anticipated that the shaft which is now down to the 272 foot level will be sunk to a greater depth,

and new machinery erected, so as to do away with the cross-head now in use in the shaft for the transportation of men to and from the mine.

GRAY ROCK AND EAST GRAY ROCK.

These mines are north of the town of Centerville, and worked as two different mines. The property was formerly owned by Davis & Talbot, and in the month of October, 1887, a purchase was made by the Butte & Boston Mining Company.

Seven years ago the ground was first broken to commence to search for a mine. A shaft was sunk to the 300 foot level, where very rich veins of ore were struck, carrying native silver. These veins in places are very large for silver veins, and many think if they had been smaller they would produce still richer rock, and be even more profitable to the company. During the seven years of labor at Gray Rock, their levels were extended so far away from the Gray Rock shaft that the company decided to sink the East Gray Rock shaft to the 400 foot level and intersect the workings of the Gray Rock, and then hoist all the Gray Rock ores through the East Gray Rock shaft; *i. e.*, when it cannot be hoisted out of the Gray Rock as cheap as through the East Gray Rock. The sinking of the East Gray Rock to the 400 foot level will open up another, 100 feet in depth, of rich ore in the East Gray Rock mine, and will ventilate both mines and make an egress through either mine.

New cages have also been put to work in these mines since my visit, as the old ones corresponded very materially with the old ones at the Silver Bow mines.

LA PLATTE.

The La Platte is located west of the Lexington, and north of the town of Centerville.

This mine was purchased from Davis & Talbot, with several other locations adjoining it, and the company is spending large sums of money in developing the several mines. The La Platte is sunk to the 232 foot level, on an incline, and anticipates shortly to sink another 100 feet. The vein is not a large one, and while the tonnage is not great, the ore is very rich, and makes up for the smallness of the vein. It is much larger at the lower level than above, and as a greater depth is attained it is expected that the vein will open out to a larger and wider one. Fourteen men are engaged in the La Platte, and several others on the other mines prospecting for the company.

Most of the town of Centerville is built on the ground of this company, by private citizens, who pay about \$1.50 per month as a rental for the ground.

BOSTON AND MONTANA MINING COMPANY.

Next to the Anaconda works in Butte, in size and wealth, are the mines owned by the above company. The mines of the company include the Mountain View, Harris and Lloyd, East and West Colusas, and Moose, all of which are working upon a large scale.

MOUNTAIN VIEW.

The Mountain View is located north of Anaconda and St. Lawrence mines, and overlooks the town of Butte on the west and Meaderville on the east.

The mine was opened up during the year 1882 by a man named "Larabie, of Deer Lodge county," who worked it for five years and spent a large amount of money, but did not get very great returns. He sank the shaft to the 600 foot level, and at each 100 feet ran drifts in all directions, and somehow managed to run every tunnel parallel with the vein, and distant about twenty feet from the vein.

At the 600 foot level the vein was discovered, and on the 27th day of July, 1887, the property was transferred to the Boston & Montana Mining Company for a good round figure, which has worked steadily ever since, yielding large profits.

A large amount of money was spent to erect new hoisting machinery at the Mountain View, and it is doubtful if it is excelled in America. Since this machinery has been at work the shaft has been sunk to the 1000 foot level and crosscuts run to strike the vein, which goes to prove the mine to a depth of 400 feet more than was opened up by Mr. Larabie, and the company has received such encouragements that much talk is afloat regarding the erection of a new smelter at Great Falls, a distance of 160 miles, which if erected will be the largest in Montana.

It is presumed that this is the same vein as the Anaconda, and that in its dip from the St. Lawrence toward the Mountain View it has become exceedingly rich—in fact some of the first class ore is so rich that it cannot be refined by their works at Butte, and is therefore sacked and shipped, some of it to Omaha and some of it to Swansea, Wales, and it is reckoned to be richer than the matte itself which comes from their own smelters. Beside the richest copper it contains "sixty per cent" of silver, which makes it the richest copper and silver mine in the world.

One hundred and ten men are engaged in the mine, who do not take out anything but smelting ore, as the reduction works of the company are too small to handle the second class ore, and thousands of tons of second class ore remain in the mine untouched awaiting the erection of a larger plant.

The ore is hauled by teams to their own works, known as the "Upper and Lower Colusa Reduction Works" at Meaderville. The hoisting engine in use can easily handle 1000 tons of dirt per day with two double deck cages. It is equipped with every modern improvement conceivable and accompanied with safety appliances unequalled in the State.

HARRIS & LLOYD.

The Harris & Lloyd adjoins the Silver Bow mine on the east and lays south of the St. Lawrence. Work commenced on this mine about one year ago by this company. Prior to the purchase of this property a long tunnel was run in the side of the mountain by J. E. Lloyd and company, who struck several veins, and it was soon decided to work the mine by sinking a shaft and abandon the tunnel which was done. A shaft has been sunk by the present company to the 400 foot level and drifts run toward the Silver Bow mine, which makes the principal part of their workings a long distance from the shaft and costly transportation for the ores. Finding the present shaft and machinery too small to work the mine properly, it was concluded a short time since to sink a new three compartment shaft about midway between their own shaft and the Silver Bow mine. A contract has been let to sink 300 feet. This shaft was down 125 feet from the surface, and when the 300 foot level is reached drifts will be run to connect with the old levels, when most of the ore will be close to the new shaft.

A large hoisting engine will be put in here before any ores are taken out, built upon the same plans as the Mountain View, only much larger. The foundation is already built for the engine, which is the strongest ever built in Butte, and when the work is complete it will be a credit to the company and to the builders of the engine (A. F. Ellis & Co.)

These improvements are not made any sooner than needed, as the "engine now in use at the old shaft is too small to use cages in the shaft," and a crosshead has been used in its place. The Legislature of 1886-7 enacted a law that no company or corporation should work a mine through a vertical shaft below the 300 foot level without the use of iron bonneted safety cages. This mine has been worked to the 400 foot level with a cross-head and bucket, which has been an open violation of the law

for some time. I cannot see any reason for drawing any line at the 300 foot level, for if a man or men was riding upon a cross-head (which is simply made of a three or four inch plank in thickness and not over eight inches wide), and when men are riding up or down a shaft on such a (so-called) piece of machinery, should become dizzy, or a shake of the rope dash them off into an open shaft, I see no possible escape for a man or men's lives, and no jury this side the eternal world ought to exonerate a company in my estimation if men's lives are thrown away by the use of crossheads in their mines, a system which would scarcely be acceptable when mining was first discovered.

The superintendent, after being notified regarding the matter, thought that to come within the bounds of the law he would cease work below the 300 foot level, but if an accident happened the chances for a man's life would not be worth a single dime, and it would be just on the part of our legislators to absolutely abolish and annihilate such a dangerous system.

EAST COLUSA.

The East Colusa is situated north of the town of Meaderville, and east of West Colusa.

This mine was owned by Mr. Lewis, and was sold to the Boston & Montana Company when the other mines were sold. The Clark's Colusa and several other mines are adjoining this mine, including the Shannon, Liquidator, and others.

The Clark's Colusa was opened to the East and West Colusas, being in the center of the two, and caved some time since to the surface. After the sale was made by Mr. Lewis, the Boston & Montana Company wanted to make connections with the East and West Colusas, which could not be done without considerable expense repairing the cave in the Clark's Colusa. A great deal of work was done by the locator of these mines without much success, but soon after this company commenced operations a very rich vein of ore was discovered. Not much time or expense was required to open a good mine, and it soon became one of the finest properties in Montana. The shaft is sunk to the 500 foot level, and where the ore has been discovered in the different tunnels it indicates that it is a permanent and paying vein.

Nothing but first-class ore is taken out of this mine, and it will require years of labor to extract the mountains of ore now remaining in the mine, which cannot be done till the new machinery is erected for reducing the ores.

WEST COLUSA.

The West Colusa is located west of East Colusa, and connects with the Clark's Colusa and Liquidator (formerly owned by McDermott). This mine is worked by the same officers as the East Colusa, and the ore taken out of either shaft, which is most convenient for the mine. It is the same vein as the East Colusa, and promises to be a long standing mine. About 120 men are employed in the two mines, and about 200 tons of first-class ore are taken out daily and hauled to the company's smelter, only a short distance from the mine.

It is rumored that a new four compartment shaft is to be sunk between these two mines from the surface, which, if done, will be the largest in the State.

MOOSE.

The Moose is located southeast of Magna Charta and Valdemere, and was formerly owned and worked by Mr. Larabie, but was purchased two years ago by the Boston & Montana Company. The workings of this mine are not so extensive as the other mines belonging to the company at Butte, as the vein is much smaller.

Not long ago they commenced sinking a new shaft, and also erected new machinery to work with. A large new shaft house has also been erected over it, covering a large space of ground, and to-day its appearance equals any in the neighborhood.

The ore taken from this mine is hauled to the company's smelter, and it is claimed that it requires a certain amount of this ore to assist in reducing the ores of the other mines, and "lots of iron ore is shipped to the smelters from other parts of the State for fluxing." Forty-four men are engaged in the mine, and most of them are drifting and sinking.

Their average shipment of ore per day amounts to about 25 tons carrying manganese. This mine is surrounded by many excellent and prominent mines, and it is expected that when the mine is sunk to a greater depth it will also increase in value, and become one of the prominent silver mines of Butte.

According to the returns of last year ending June 30, 1889, this company is well rewarded for its outlay in Butte. "Net returns for the year were \$2,923,603. Expenses in labor, materials, machinery, etc., \$1,015,990, leaving to the company a profit of \$1,907,613; and after purchasing property, etc., the balance in favor of the company was \$400,000, besides making a large dividend.

PARROT.

The Parrot is located south of the Anaconda, and is also a rich mine. Several mines in this neighborhood have been prospected to a small depth, and have failed to make very great returns. The Shakespeare east of it, and the Ramsdell Parrot have worked several times and failed to be of any profit.

The Parrot has the only four compartment shaft in Montana, and it only commences at the 400 foot level and is sunk to the 750 foot level. This is known among miners as the best developed mine in Montana, and the best ventilated; the Superintendent having made it a life study to ventilate mines in the coal regions of Wales and Pennsylvania. At the end of each month the developments of the mine are plainly marked out upon glass at the surface, which shows every set of timbers placed in the mine from the commencement of the mine.

Work commenced on this mine May 31, 1881, and has worked continuously ever since, except when compelled to suspend on account of no water to work with at the mill. Owing to repairs at the mill during the early part of the year, the mine was idle for fully three months; but during the nine months of work 63,000 tons of ore were brought to surface, or an average of 7,000 tons per month, or nearly an average of 260 tons per day. This is about the only mine in Butte that does not work on Sunday, and there is no doubt but what this is an essential to all laboring men. Ninety-nine per cent. at least are men who came to the west from places where the Sabbath is set aside for rest, and all moral men look for the coming of their day of rest as much as they expect to hear the sound of the whistle on the week day to notify them of their time for labor. It most certainly is not the desire of men to violate those rights and privileges which have been handed down to them from time immemorial; but it is at the request of those who are at the head of those mines that they are imposed upon to perform a work on the Sabbath day that nature itself would reject. All civilized lands have a day which they accept as a day of rest, irrespective of religious beliefs; and thousands of our eastern miners to-day dread coming into the west because of the violation of that day of rest and recuperation.

It is doubtful if the miners of any mine in Montana average over 27 days' work per month, owing to repairs to the machinery, etc.; and if they would attend to such matters on the Sunday, which would only require a limited number of men to do it, then would the wages be as much, and the people of all nations be able to retain their moral rights; and many whose nature it is to perform religious rites would not be molested nor

suppressed by those whose finances and influences are above the laboring men.

The general output from the Parrot and Champion mines, reduced at the smelter south of Butte, was 79,975 tons. The company also owns the Grey Eagle, Shakespeare and Parrot No. 7 locations.

Only two accidents has ever occurred in the Parrot which has proved fatal, the last being nearly four years ago when Wm. Miles met his death. It has been rumored (and I am informed that such rumors are true) that a new engine is to be erected at this mine equal to anything ever put in motion in Montana, and a new shaft house erected much larger than the present one, to correspond with the engine. Their work has been retarded during the fall owing to the draught during the past summer.

The smelter of the company is reckoned to be the largest in Butte and works a great amount of custom ores.

CHAMPION.

The Champion is located about one mile north of Burlington. This is worked by the same company as the Parrot and under the direction of the superintendent, B. Tibby.

The shaft is sunk to the 300 foot level and tunnels run about each 100 feet to the vein. The vein carries rich silver and for the size of the vein is not equalled in the neighborhood. With a force of thirty employes at work about fifteen tons of ore per day is taken out and sent to the smelter.

LEXINGTON.

The Lexington is situated between Centerville and Walker-ville and is the deepest mine in Montana, having reached the 1400 foot level, and like the rich mines of Nevada, the greater the depth the richer the ore. The principal owners are capitalists of Paris. The mines has the most extensive tunnels of any in Butte, as some of them are fully one mile in length, and every hundred feet sunk in this mine extends the working for a long period. The vein bears silver of a moderately high grade, but our silver mines in general does not have so large veins as the copper mines and their returns are not equal to those larger copper mines, while the cost of working them is much smaller than the larger veins and the danger to the employes much less.

The mine was first owned by A. J. Davis and was worked by him for about five years, when it was sold to the Lexington

Mining Company, who has worked continuously for the last nine years. During the year 1888 the returns of the company amounted to \$823,000, which required the amount of 225 men to get the ore to the surface at \$3.50 per day.

The ore is reduced at the company's smelter adjoining the mine, and as the ore comes out of the mine it is placed in the mill without further handling. Two mills are at work, the one 60 stamps and the Old Lexington mill a 20 stamps. At the 500 foot level a diamond drill was at work drilling a long hole into the foot wall prior to running a drift to discover if there was any vein matter in the foot. The drill is capable of boring a hole 300 feet deep, but does not necessarily prove a vein at any place in that distance. All of our mines have poor streaks which in some cases runs for hundreds of feet, and the only true method to test a vein is by developing it, although this sometimes defines the quality of a vein and gives an idea how long a crosscut has to be run to strike it.

Several places in this mine could have been better ventilated, but most of them were drifts running to make connections with other places to bring about good ventilation.

ALICE & MAGNA CHARTA.

The Alice is located north of the town of Walkerville and has been worked for sixteen years continuously, except a few months during 1887, when operations were suspended owing to the high freight rates on salt charged by the Utah & Northern Railroad company from Salt Lake City to Butte. Every company in Butte was interested in this matter and the Union Pacific was petitioned to lower the charges, as it threatened destruction to the camp.

Concessions were soon made by the Union Pacific company and the mine started up again with a full force of men. The shaft is now sunk to the 1100 foot level and stations are being cut at the 1100 foot level. When these are complete the shaft will be sunk another hundred feet, and when the stations are completed at the 1200 foot level a crosscut will be driven at each level to strike the vein.

The ore produced is of very low grade, not averaging over \$30 per ton, which is unusually low for a native silver mine, but with the large amount of ore reduced and the cheap facilities for reducing it the company receives from this mine and the Magna Charta splendid profits.

These two mines are owned and worked by the same company and the ore crushed together in the same stamp mill.

They are connected at almost every tunnel and are worked as one mine. The ore produced at the Magna Charta is hoisted through the Magna Charta shaft, and in order to get it to the mill a "trestle" works had to be erected from the Magna Charta to Alice and the highest point is 72 feet above ground.

One hundred and thirty-eight men are employed in these mines, who send about 260 tons of ore to the mills daily. An So stamp mill adjoins the mine and the ore is placed in the mill without further handling.

The pumping machinery in the Alice is acknowledged by all mining men to be the best in Montana. For years they used the Knowles pumps, which caused an enormous cost to their fuel, and concluded to use the Cornish pump. It cost the company \$65,000 to secure the plant and get it ready to work, but after it was ready for use the fuel was reduced from nineteen cords of wood per day to about eight cords, saving to the company at least \$50 per day in fuel only. No steam has to be forced down the mine to work these pumps with, but when the engine is set in motion at the surface, each and every part of the engine is at work from top to bottom and forces the water to the surface faster than any other in use. A person can stand within two feet to the engine in any part of the mine and would not know it was at work except it was seen, for it moves so truly that it is noiseless.

BLUE WING.

The Blue Wing is located in the center of Walkerville, and most of the town is built upon ground belonging to the company. Work commenced on this mine some years ago by a party of prospectors, who sunk a shaft to the 300 foot level on an incline, when they sold it to the Alice Mining Company. Not much work had been done on the property for several years, until a few months since, when the Alice Company started up. It became necessary to erect a new shaft house, which was done, and one of the engines which was used at the Alice mine for a long time was put up to do the hoisting. The shaft was also changed from an incline to vertical, so that cages could be used instead of buckets. This also required the cutting of stations at the several levels, which was being done, and this caused a general tear-up of old timbers to make more modern improvements for future developments. It is anticipated that this will be a rich mine for many years to come. The company also owns the Boston, Rising Star, Plover West, Garfield, Reefe, Walkerville and Curry, but are not doing any work except assessment.

They are all located in Silver Bow county.

MOULTON.

The Moulton is situated west of the Alice and north of Walkerville, with the Amy and Silversmith on the west. This mine has been worked for about ten years, and seven-eighths of it are owned by W. A. Clark, of Butte. The mine is sunk to the 715 foot level, and connections were just being made to the 600 foot level by a raise, in order to ventilate the lower level and to make an escape way. The usual number of men employed in this mine is about 85, but during the summer less than 30 were employed, as no ores could be reduced at the mills and smelters for want of water to work the mill with, and only "dead work" has been done during the summer. The Moulton is a large silver mine, and has a 60 stamp mill close to the mine; but like the silver mines in that neighborhood, the ore is low grade, and it requires a large quantity to make the mine a success. A raise was being pushed through from the 300 foot level to open a large piece of undeveloped ground near the surface.

During the many years this mine has worked, "not a single man has been deprived of his life," which is the most fortunate mine in the neighborhood. J. K. Clarke superintends the mine and mill, and everything works satisfactorily.

GANGON.

The Gangon is located in the center of the city of Butte. "This mine was worked for many years by Col. Thornton without any good results, and in the year 1883 the colonel was ready to abandon further developments;" but, like the prospectors are in general, he wanted to give it one more trial, and secured the services of J. R. Gilbert to take charge of the mine.

"After an examination of the mine was made it was thought that the only way to prove the mine would be to sink it another 200 feet. Sinking was resumed, and before Mr. Gilbert left to take charge of the mines belonging to the Helena Mining and Reduction Company, a rich vein of ore was discovered, and an indebtedness of \$70,000 paid off, and a like amount left to the credit of the colonel." Since that time the property has been transferred to the Colorado Mining and Smelting Company, who have spent large sums of money to develop the mine, with good results. The Gangon is one of the oldest mines in Butte. The shaft is sunk to the 800 foot level on an incline, and is the only shaft through which their dirt is hoisted.

Eighty men are employed digging out the ores, which keeps a large number of men employed at the Colorado smelter,

south of town. The principal workings are from the 400 foot level to the 800 foot level, as most of the upper levels were worked out by the former owners.

The principal owners are residents of Denver City, Colorado, and the greatest part of the business is transacted in that city.

They had a skip at work in their shaft (which is fifteen degrees from vertical) without a bonnet, which in my estimation was needed as much as in a vertical shaft; and I directed the manager's attention to the matter, which he was ready to do for the safety of the employes. They were placing an electric plant at their mine for their use, at the different levels beneath the mine, and also on top, which makes a decided improvement in any mine.

The returns from the mine from Dec. 1st, 1887, to Dec. 1st, 1888, were exceedingly great for a mine of its size, having returned 21,000 tons of ore, averaging \$28.50 per ton; or a gross output of nearly \$700,000 during the year.

The mine is at present under the management of C. W. Goodale, who is thoroughly conversant with mining in general. The water pumped out of the mine is used during the summer for sprinkling the streets of Butte, and it seems reasonable that the water could be used by the fire company to assist to extinguish fires in the city. The mine is much higher than most of the houses in Butte, and would have a pressure strong enough to cover the business portion of the town. After the great fire in Butte, which occurred on the 29th of September last, and which for a time threatened to burn the entire town, it was thought that the City Council would at an early opportunity make arrangements for the use of the water for fire purposes, as the Superintendent (who is a member of the Council) proffered it to the city on very reasonable terms.

Since the fire, the old walls of the damaged houses have been removed and more substantial buildings erected in their places, and to-day (less than three months) business has resumed in the new four-story buildings.

NETTIE.

The Nettie is situated near Burlington and about three miles from Butte, and is developed by the Colorado Mining Company. This mine was opened up about eight years ago and after the shaft was sunk about fifty feet work was suspended. Soon after the Colorado Mining and Smelting Company purchased the mine and sunk the shaft to the 300 foot level. In the

year 1887 it seemed evident that she could only work a few days longer, and an order was given to crosscut for the vein till the first day of June, and if nothing was discovered to close down. On the 27th day of May a vein was struck, and during that year 5,000 tons of ore (smelting and milling) was taken out of the mine, valued at \$82,000.

At the 300 foot level a long crosscut is driven, then a winze sunk 170 feet. At the top of the winze a small engine is fixed to hoist the dirt out of the incline, which is broken in the different stopes and tunnels branching off from the winze. The ore is principally galena and is hauled to the Colorado smelter for reduction.

There is a piece of ground in this mine known as the slide, which separates the vein. The richest of the ore is close to the slide on both sides, but it is a difficult matter to run a drift through the slide, and they are often compelled to abandon their labor in trying to go through it.

The company also owns the West Nellie, which is worked by four leasers. The South Nellie, also worked by four leasers, and the Burlington worked by two leasers. They are also the owners of the Fredonia, Independence, Selfrising and Barango claims, but none of them are at work.

WABASH.

The Wabash is located two miles north of Walkerville and worked by Capt. Emerson and A. J. Davis. Formerly the vein was worked from an incline shaft south of the present one, but since a new vertical shaft has been sunk a party of leasers has been engaged in extracting ore from the incline, paying a royalty of twenty-five per cent on their entire output. During the month of September Capt. Emerson received the sum of \$2,500 as royalty, and this encourages him to go deeper down with a vertical shaft. The new shaft is down to the 200 foot level, and a cross-cut run south several hundred feet where two large veins were struck, and it is anticipated that when these are opened up on, that it will make one of the richest mines ever discovered in Montana. The air could be improved on very much, and work was being pushed ahead as rapidly as possible to connect to the workings of the old incline.

There are scores if not hundreds of leads in this neighborhood which can be easily traced by the float on top, and it is believed that the day will soon arrive when many large mines will be opened up in that canyon. Prospectors are at work on every hand, willing to spend all they have to justify their hopes.

ORIGINAL.

The Original is located near the Gangon and is close to the main street of Butte. It is generally conceded to be the oldest mine in Butte (hence the name Original.) It has not been worked as much as some of the mines, nor is it developed to so great an extent as most of them are, owing to the fact that it has been closed down for years since first opened. The mine is now being worked by the Original Mining Company, with the Hon. W. A. Clark as its principal director and owner. The shaft is sunk to a depth of 300 feet on an incline. Crosscuts are driven at the several levels to the vein, but most of the work is being done at the 500 foot level. A crosscut was driven about 200 feet, when the vein was struck which was moderately rich in silver, and work is going on in the stopes above the level extracting large quantities of good ore, when it is sent to the Butte Reduction works. The shaft was being sunk to the 600 foot level, and when this is complete a large quantity of ground would be laid open for future working. Some improvements were needed in this mine and the matter was laid before the management, who promptly and willingly attended to it for the safety of the employees.

CLARK FRACTION.

The Clark Fraction is about two hundred yards north of Walkerville, and is a small fraction between the Alice and Magna Charta claims, "being only forty feet in width." Not much work is being done in this mine at present. A shaft has been sunk to the 500 foot level and a crosscut run to strike the vein at the bottom level; also a drift run on the vein east of the shaft, but no other work is going on. Only one shaft was in the mine and no other means of egress in case of emergency, but if the vein justified the working of the mine another way of escape would be opened up, so as to prevent any lives being endangered.

BLACK ROCK.

The Black Rock is located north of Modoc and Speculator mines and east of Elm Orlu. This mine is the personal property of W. A. Clark. The shaft is sunk to the 500 foot level, where a large body of ore was discovered, but of low grade, and when the Butte Reduction works are completed a large force of men will be employed. The vein carries principally gold and silver, and although it is low grade any amount of it can be taken out daily and reduced very cheaply, and return large profits to the

owner. A great deal of prospecting has been done in this canyon, but most of them have abandoned, and at present the only work done is at the Black Rock and Elm Orlu mines.

ELM ORLU.

The Elm Orlu is adjoining the Black Rock. But little work is being done, and it is thought that ere long the engine on this shaft will be idle, and the vein worked from the tunnels of the Black Rock, and do away with one set of boilers and engineers, as the mine could be worked cheaper from the Black Rock shaft than by the Elm Orlu.

SPECULATOR.

The Speculator is situated east of High Ore and west of Modoc mines. At the time of my visit not much work was being done here, the work having been suspended to put in a fanning machine to ventilate the mine with. The mine is leased by three men, who employ eight men to develop it. The shaft is sunk to the 400 foot level on an incline, then a crosscut driven about 100 feet from the shaft. About 50 feet from the shaft a large vein was struck, and a drift was being driven on the vein, while a richer ore was looked for by running the crosscut a small distance farther on. A bucket was being used to hoist and lower men with, and I suggested the propriety of putting in a self-dumping skip, with a bonnet, and safety appliances; for if a rope broke while the men were going down or coming up, the probabilities are that they would be killed; but with the safety appliances such dangers would be avoided. The management soon realized the justness of a change in their machinery, and readily consented to the change. Had the incline been of the same grade, an adjustable cage might have been used; but owing to the changes in the grade of the incline, the self-dumping skip was about the only safe remedy that could be used to prevent danger, and much more convenient for developing the mine.

BLUE BIRD.

The Blue Bird is situated three miles west of Butte City, and just a little south of the town of Burlington, and overlooks the town of Rocker, where the mill and smelter of the company were at work. This mine has for several years been the main support of Burlington, and it was a promising and thriving town until recently, when suit was entered against the company by the Darling Mining Company for about \$2,000,000 for ground alleged to have been worked by the Blue Bird

Company which was the property of the Darling Company. Later the Blue Bird Company sued the Darling Company for \$25,000, and the two suits are now before the courts, and promise to be the greatest mining contests ever placed before the courts in Montana. Nearly every prominent mining man in and around Butte has examined the property, and will act as witness in the case.

Owing to the law suit on hand, the Blue Bird ceased working, and it is a difficult matter to determine when the case will be settled, and the mine opened up again; and many industrious miners have been compelled to leave the camp to seek employment elsewhere. The Blue Bird is one of the largest silver mines in the State, and usually produced 200 tons of ore per day. The shaft is sunk to the 600 foot level, with a vein averaging about three feet in width, and promises to be a mine of many years standing.

Other mines are at work in this neighborhood by the Blue Bird Company, but not so extensively as the Blue Bird. In passing from Burlington to Butte over the county road there are over 150 patented mining claims. Some of them are at work making excellent returns, while many of them are idle.

Most of them are owned by men without capital, who will go to work at day wages during some parts of the year, earning a few dollars, which they spend during other seasons of the year to develop the mines. It only requires the work of richer men to interest themselves in these mines, who can develop them on a larger scale, and the day would not be far distant when some of the prospect holes would be placed upon the list as dividend paying mines. Very few of our mines have been valuable close to the surface, and the richest mine in Butte to-day has a cap of non-paying mineral 280 feet thick on top of the great copper belt, so that in order to reach the pay ore thousands of dollars were spent to make a success of the mine.

GOLDSMITH.

The Goldsmith is situated west of the Amy and Silver-smith, and north of Walkerville. This mine has been opened up for six years by George H. Yong, who sank a shaft 500 feet deep and drove several tunnels; but no work has been done in opening out any stopes, although the ore is rich with silver.

The ore taken from the drifts is reduced at the Parrot smelter, and the mine promises to be valuable; but the general impression is that the owner anticipates selling the property, *i.e.*, if he can get his own price. Several prominent mining men are

looking after the property, and should a company take hold of it, the chances are that it would be the richest in Montana.

Sixteen men are employed in drifting and raising, but if a company should commence to develop it they could easily employ 75 men.

AMY AND SILVERSMITH.

The Amy and Silversmith is located between the Moulton and Goldsmith mines. The mine is owned by Charles Warren, George Irvine No. 2, and Marcus Daly. After doing considerable work on the mine, sinking a shaft 500 feet deep and opening up several drifts and stopes, the entire workings were suspended.

About one year ago Mr. Daly took a lease on the mine, and commenced to run several drifts, and stope the ground from the 300 foot level up to the 200 foot level. The ore was taken to the Parrot reduction works, and produced both silver and gold, and proved to be a valuable mine. The ore taken out is supposed to be the richest in Butte, assaying from \$500 to \$800 per ton.

SANKEY & MOODY.

The Sankey & Moody is situated north of Burlington about one mile. An incline was sunk on the property by its owners about 200 feet, and a tunnel or two run at the 100 and 200 foot levels, but without any satisfactory results, and labor was suspended. Some time ago a bond was taken on the property by Mr. B. F. Fine for the term of nine months, who commenced to develop the mine for what it was worth. After working several months he concluded to sink another incline north of the old one, and should anything be discovered of any value a new vertical shaft will be sunk, and machinery put up to use cages, etc.

The Sankey & Moody is in a good mineral district, and surrounded by a number of veins. None of them have been worked upon very much, except the Champion, which has proved itself to be valuable.

Mr. Fine is confident that his labors will be well paid for, and is willing to lay out considerable expense to develop the lead. Some very rich strikes have been made in the mine already, but have only proved to be in pockets, which are apt to lead to a rich lead as they go down. Should this mine turn out as expected, prospectors will be encouraged, and much work will be done to find more leads.

GREAT REPUBLIC.

The Great Republic is located close to the town of Burlington. Not much work was being done at the time I visited the mine, owing to the large quantities of water, and new pumping machinery had to be put in to handle the water with. For several days the water had been raising in the mine on account of breakages to the pumps prior to putting in new. A shaft was sunk to the 300 foot level and crosscuts driven to the vein. Every hope is entertained that the mine will be a good one, and should it prove to be, it will build up the town of Burlington again and fill the houses with residents, vacated by the closing down of the Blue Bird. Only one shaft was on the mine, and in case of fire to the shaft house the chances are that the miners would suffocate. This is a poor system, and our legislators should enact a law compelling every company to have an air shaft carried down with the mine, which would insure a means of escape independent of the main shaft. To show the necessity of such a law, it can be easily proven from the occurrence at the Black Rock mine last year. The miners of the Black Rock were busy at work and the shaft house by some means caught on fire, and if there was no way for them to get out except the main shaft, every man in the mine would have been suffocated, and sixteen dead bodies would have been taken out of the mine. It happened that the mine was well provided with an air shaft and every man came out alive. Too often is it the case that some dreadful catastrophe must happen before the necessary precautions are taken, and it would be to the interest of every miner in Montana to have a law enacted that would bring about certain egress to the employes.

There are hundreds of other mines in Silver Bow county which makes splendid showings and steady returns, and which will some day come forward and make large dividend mines. No less than 1300 patents have been granted in Silver Bow county for mining claims, which exceeds any other county in America, and it is doubtful if many smaller counties can be found. It is generally conceded by mining men that the mining industry in Butte is in its infancy. Very few of the mines are at a great depth, and those longer standing mines which has been sunk from 1000 to 1400 foot levels are proof positive that the deeper the mines have been sunk the richer and greater the veins have turned out.

During the time of digging the sewer ditches through the streets only a few feet in depth many rich strikes were made, and it is almost impossible for prospectors to drive in any direction but what veins of some kind are reached.

Fully 5,000 miners are employed in this county, and no county in America can boast of so many mines and miners as this. When the higeway was lined with mule teams and oxen (and some of our millionaires to-day were the principal owners of these teams) provisions were exceedingly high and the pioneers of Montana can well remember when flour was worth at least \$40 per hundred and all other provisions on an equal footing, but to-day we compare favorably with those of eastern cities. It is surprising that we cannot get animal food even cheaper in Montana than in the East, as the markets of the East are supplied with beef, etc., from the mountains of Montana, and the freight charges to the New York and Chicago markets must be exceedingly great.

The copper mines of Northern Michigan pays its employes about \$45 per month, and against board, etc., is paid for, there is not an average of \$20 left. In Montana miners' wages foots up to an average of \$100, and when board, etc., is paid for, the sum of \$70 is left for other purposes. So that if our mines were not infinitely richer than those of Michigan, we could not compete with the copper mines of that neighborhood.

Nevada miners were once paid higher wages than is paid in Montana, and the Miners' Union were strong against any miner working for a less compensation than \$4.00 per day *United States gold coin*, and no miner was allowed by their constitution to accept greenbacks or anything in lieu of gold for his wages. Every Miners' Union in the State was affiliated, as was also some of the Unions of California. These Unions were private organizations and nothing above a shift boss was allowed to join the society. Foremen and superintendents were refused admission. So long as these mines retained their richness this standard of wages was paid, but when the mines became poor the miners were compelled to consent to lower wages or the mines close down.

Several meetings were convened by the Union of Austin, Nevada, to discuss the matter, and as a result a reduction of \$1 per day was agreed to. Soon after it was the general wages paid in the State. Montana has also its Miners' Union, and an interest is taken in it by business men as well as the miner and in many instances they help to support it. The standard wages here is \$3.50 per day, and the day is far distant when our mining companies will have to complain of too high wages, on account of poverty in the mines.

One great question to be solved in the interest of the miner is the issuance or non-issuance of patents to the railroad companies for mineral grounds. If patents are issued to the railroad companies for every odd section of ground within a limit of

twenty miles each side of the main track for the entire length of Montana, then thousands of mining claims would be included, and the mining industry of Montana be ruined, and every other industry would receive a death blow; while millions of dollars would be put into the treasury of the Northern Pacific, and drained out of the pockets of the citizens of Montana.

WICKES.

The Wickes mines are not so numerous as those of Butte, but they are about the largest lead producers of the world. Prospecting this neighborhood commenced about twenty years ago, but no great returns were made till about 1884. Large sums of money were spent, and "rich companies became broke" trying to work these mines; but all in vain, and the mines closed down several times.

In 1882-3 several changes were made, but after trying several processes to make the ore pay, abandoned work entirely.

Many families who were residents of Wickes would have gladly gone to other places to work in the summer of 1883, but they had waited around so long, expecting the Alta-Montana Company would resume work, until their capital had been all spent, and "merchants who went there from Helena with groceries, etc., demanded money before letting out their goods, and if cash was not paid, credit was useless."

While in this perilous condition, S. T. Hauser, D. C. Corbin and others purchased the Alta, Comet, Northern Pacific, Custer, and other mines, and also the smelting plant at Wickes. This revived the citizens of Wickes. The Northern Pacific track was only 19 miles distant, and a branch line was soon built from Prickly Pear Junction to Wickes, passing *via* Montana City, Clancy, Jefferson and Corbin, "which proved to be the best paying road in connection with the entire line" at per mile of road. The former mining companies could not make any ore pay that was worth less than \$100 per ton, and since this was scarce to be found a reduction plant of some other kind must be erected. The name of the company changed from the Alta-Montana to Helena Mining and Reduction Company. The new board of directors selected John Longmaid to take charge of the works, who erected a new concentrator at Corbin, two miles from Wickes, to reduce the Alta ore. (This concentrator is supposed to be the largest in Montana.) The concentrator was soon completed, and the Alta mine opened up, and "ore worth only \$12 per ton was worked at a profit." After the erection of the new concentrator, Mr. Longmaid's attention was directed solely to the smelter and concentrator, and J. R. Gilbert engaged

to take charge of the mines as assistant superintendent, who has continued in that position for about six years. A concentrator was also put up at the Comet mine, and the concentrates shipped to the smelter at Wickes, as was also some smelting ore from both mines, too rich to concentrate. During the summer of 1884, Wickes was a prosperous town, and residents began to build large homes. Large hotels were built, and some large halls to transact business for lodges, etc. In the year 1886 the I. O. O. F. erected the finest hall in the town, when a new lodge was opened up, and has thrived ever since. A large hospital has been built, where the miners are furnished medical attendance and board by the company, in case of sickness or injury, for which the company deducts \$1 per month from all employes.

Hundreds of men were soon at work in mines and mills, and I am informed that "during the month of May of 1884, nearly \$100,000 was paid back to the company in dividends."

When this proved so well, others commenced prospecting, and other mines are producing rich mineral.

In February, 1885, Mr. Longmaid was succeeded by Prof. Aug. Raht as general superintendent, who has remained ever since. In 1887 much talk was going around that the old smelter at Wickes was too small to smelt the ore coming from the different mines, and several places were mentioned where the new one was to be erected, which finally was erected at East Helena. Some say that it would have been erected at Wickes, "but owing to excessive assessments of the county assessor of Jefferson county, the worth of the plant would soon be paid over to the county, and any other place but Wickes was favored." This meant poverty to Wickes, as fully 300 men were employed at \$3, making a circulation of \$900 per day in that town; but when work commenced at East Helena, most of the residents of Wickes moved to East Helena and built up a much nicer town than Wickes, in a much better location, and in less than two years it has grown to a larger town than Wickes did in twenty. The new smelter is large enough to smelt all the ore brought from their own mines, and any amount of custom ores from other parts of the State.

At the time the new smelter was built, other parties became interested in the mines of the Helena Mining and Reduction Works and also the new smelter, and the name of the company again changed to Helena Livingston Smelting and Reduction Company.

ALTA.

The Alta mine is situated north of Wickes about one mile, and is the richest lead and silver mine ever discovered in the

neighborhood. It also carries gold. The mine was first prospected by a man named Williams, in 1869, who did most of his work digging small prospect holes in the ground. Some time after the Alta-Montana Mining Company purchased the mine, and spent fortunes in working it, but without success, and in 1883 abandoned it.

From the top of the mountain which divides the Wickes and Gregory canyons to a gulch leading to Corbin it is 1,000 feet vertical, and in this mountain were run six tunnels, all of them being from 500 to 1,000 feet from the mouth of the tunnel. The vein was discovered by them in every tunnel except the lower one (No. 8), but as nothing but smelting ore was wanted, it proved to be valueless. The ore taken from the vein had to be carefully sorted out so that it could be treated successfully at the smelter, and it cost more to get it ready for smelting than it was worth when run into bullion. A change took place in 1883, when the H. M. & R. Company succeeded the Alta-Montana, and Superintendent Longmaid was engaged. Work was pushed forward as rapidly as possible during the fall of 1883, running drifts, etc., while the concentrator was being erected at Corbin; and in the summer of 1884 the number of men was reduced from 100 to 21, who could furnish the concentrator with 150 tons of ore per day.

At tunnel No. 2 a large body of ore was opened up, and with only four men at work in the stope about half of the ore from the mine was taken out of this stope. This lead has been worked from a tunnel which is only a few feet from the top of the mountain, to the No. 8 tunnel, with more than ordinary results. For years the lower tunnel was worked successfully, and often would the miners themselves express their opinion regarding the lower part of the mine, and believed the ore did not reach down to the No. 8 tunnel. At No. 7 the vein was about 1,100 feet from the mouth of the tunnel, and was an exceedingly rich vein; but when No. 8 had passed this ore and nothing was discovered, all hopes were gone; but still they continued to drive the tunnel until it reached 3,000 feet, and discovered the largest body of ore ever discovered in the mine.

When Mr. Raht took charge of the mine it was pinched in every part, and it was a difficult matter to get ore enough to keep the concentrator going, and the teams would be compelled to wait to get the ore taken out before the wagons could be filled; but in June most every part of the mine was full of ore, and from that day to this the mine has always been filled with ore of the finest quality, and a steady shipment made daily of about 220 tons. During this fall, preparations are being made to sink below the No. 8 tunnel. The machinery is all placed in

the mine (except boilers), and it is expected that 500 feet will be sunk without delay. Ore chutes have been built in the mine, capable of holding several hundred tons of dirt, which will be kept filled with ore from the lower part of the mine. Formerly all the ore was shipped to Corbin by teams, which cost about 75 cents per ton to haul; but during the summer of 1888 a railroad was built by the company from the lower tunnel of the mine to the concentrator, which crosses under the Montana Central railroad at Corbin. A small engine weighing 7 tons hauls the ore from the mine to the concentrator. The cars are hauled into the mine with mules and filled from the chutes, which are then taken out and attached to the engine, and in a few minutes the ore is at the concentrator. This engine is capable of hauling 300 tons each day, and the cost does not amount to one-third of former shipping. About 90 men are employed at present. Some years ago it looked a lonely, dismal spot, with only one house on it; but of late the miners are building some good houses, and now it shows a more pleasing appearance.

The mine is secured by the largest timbers that can be got, and mountains of them are being used.

COMET.

The Comet is located four miles west of Wickes, and worked by the same company. For some time the ore taken out of the mine was shipped to Wickes with teams, but in 1884 a tramway was built through the canyon over the high mountains leading to the Comet. This is built with an endless rope over pulleys, which is supported by cross posts about 20 feet from the ground, and buckets attached to the rope about each 100 feet apart, which are filled and emptied without the bucket coming to a standstill. Each bucket carries about 300 pounds of concentrates, and this is a cheap way of conveying the ores to the smelter.

The Comet is sunk to the 500 foot level, and several tunnels run on the lead the entire length of the claim, and have produced large quantities of ore. In July, 1888, the mine closed down temporarily, and rumors were afloat that she would not work again; but after being idle only four weeks, work was resumed by the company, and has continued to work since with a force of 35 men, and has a steady output of ore averaging 60 tons per day.

Several mines have been at work in this neighborhood for years, including the Rumley, East Rumley and Silver Hill. The former mines are owned by A. M. Holter and brother, and are leased by a few old-time prospectors, who are receiving good returns and paying to the owners a good royalty.

MOLLIE M'GREGOR.

The Mollie McGregor is situated one mile southwest of Comet, between Boulder City and Comet mine. Some years ago A. G. Clarke & Co. opened up the mine and sank a vertical shaft 200 feet, without any good returns, and suspended labor. A large mill was put up at the mine to reduce the ore, which proved a failure to the company. Some time ago W. A. Bumby, George Ham and others took a lease on the mine, and commenced to work with a force of 8 men. Several car loads of ore were taken out and sent to the Helena sampling works, which proved satisfactory; but the ore sent since August month has not turned out as expected, and the leasers talked of leasing the Amazon mill, about three miles from the mine, and reduce their own ore. Their lease called for the sinking of the shaft 100 feet each year, and they were putting in a pump to get ready for sinking to the 300 foot level.

MINAH.

The Minah is situated north of Wickes about three miles. This mine has been worked by Joseph Briscoe, (one of Helena's prominent mining men), since 1885, and after working the Minah some time he concluded that it would be wise to locate more claims adjoining it. From the commencement until now regular shipments of good galena ore have been made, and it is one of the best paying mines in the State. Most of the ore is shipped to Great Falls for reduction, by the Montana Central railroad. During the summer a mining company from London, England, has been inspecting the mine with a view to making a purchase, and from all accounts a sale has been made for the sum of \$400,000, and the property will in a few days be transferred to the new company.

North of this mine is the Gregory, a mine that worked for some time, but proved a complete failure. In 1885 a "certain amount of money was appropriated toward working this mine, after a very radical promise was made to put it on a paying basis if the money was forthcoming;" but after the money was advanced it is generally conceded that it was appropriated to erecting costly hoisting machinery and a mill, and the mine worked but little. This seems to be an old time system, viz: erecting a mill, etc., before a mine is discovered, and when a certain amount of money was laid out the funds were exhausted and the end reached. With so many rich mines around the Gregory, it seems reasonable that the Gregory must also be worthy of a better trial than it ever had. The ore taken from

the mine was even richer than any in the district, and after it was put through the mill it appeared that some of the best of it was out on the waste dump, and a party of men who leased the dump afterwards made themselves rich, while the shipments of the mine were never worth mentioning.

When the superintendent closed down the mine in 1886, some of the directors were present, but several thousands of dollars were owed to the miners, and the miners were desirous of securing a settlement for their labor promptly. Appealing to the directors present, no satisfactory answer could be given why the money was not brought to pay them with, and the hoisting works were soon turned into a prisoner's cell (with less than prisoner's diet); and the miners were so enraged at the treatment received, that some of the directors were imprisoned in the hoisting works, while the others were let go free to secure the money. The miners held a meeting with the millmen, and a committee was delegated to wait on the prisoners behind the bar, and in less than 24 hours the money was paid, and every man satisfied.

The directors themselves believed the men were justified in their doings, and it will be a night long to be remembered by all who were present, as well as by the friends who were at home wondering why their friends had not returned.

Several other prospectors have worked around the Gregory, but have not come out enriched by their labors.

LIST OF ACCIDENTS.

NAMES OF MEN KILLED.	Date.	Name of Mine.
Andrew Johnson	July 13, 1889	Nile
Benjamin Temby	July 9, 1889	Alta
William O'Rourke	August 3, 1889	St. Lawrence
E. R. Jones.....	Sept. 28, 1889	Oro Cache
SUFFOCATED IN THE ANACONDA FIRE.	Date.	Name of Mine.
Henry Page	Nov. 23, 1889	Anaconda
Tim Kellerer.....	Nov. 23, 1889	Anaconda
Edward Dolan.....	Nov. 23, 1889	Anaconda
Matt. Sullivan.....	Nov. 23, 1889	Anaconda
Pat Murphy	Nov. 23, 1889	Anaconda
Pat Lyons*	Nov. 23, 1889	Anaconda

* Died two weeks after being taken out of the mine.

LIST OF ACCIDENTS—CONTINUED.

NAMES OF MEN INJURED.	Date.	Name of Mine.
Mike Sullivan.....	June 7, 1889	Livingston
Jerry Holland.....	June 7, 1889	Livingston
John Blight	July 3, 1889	Alta
Peter McGill.....	July 9, 1889	Gran. Mountain
Joseph Giles.....	August 5, 1889	Gran. Mountain
Thomas Sheers.....	August 15, 1889	Gangon
William Walla.....		Gangon
A. J. Nichols	Sept. 17, 1889	West Colusa
Farrel.....	Sept. 10, 1889	Anaconda
Charles Lanier.....	Nov. 10, 1889	Alice
John Maynard	August 23, 1889	Moose

ACCIDENTS.

During the past six months the accidents in our mines have been comparatively small, considering that "20,000" men are engaged in Montana who work in our mines. We have only been called upon to examine two accidents which come under the mining inspector's bill, and without the Anaconda only two men have been killed in mines where over four-men have been employed. At the Nile only two men were leasing, and at the Oro Cache the man Jones was working alone. The recent occurrence at the Anaconda was not owing to any danger existing in the mine, but by men volunteering to descend a shaft full of smoke where no human being could retain consciousness; an account of which I will give further on in my report.

FATAL ACCIDENTS.

On the 3d of July two men (Thomas Matson and Andrew Johnson) were engaged in sinking an incline in the Nile mine, one-half mile from Burlington. The ground was of a soft nature, and logging had to be driven ahead of the set, which should have been supported by a false set prior to putting in a permanent set. The shaft was only 30 feet from the surface, and was surrounded by waste dirt from the top. Before the permanent set was put in its place, and while they were getting ready for the posts, the fine dirt began to fall against the lagging and loosened the blocking of the sets above; and before either of the men could escape, the shaft caved to the surface and both men were entombed. Willing hands came from Burlington to rescue the entombed miners. Thomas Matson was the first discovered, and was taken out alive about 7 o'clock the same evening, with little injury.

Johnson was heard to speak several times distinctly while they were trying to rescue him, but some time before midnight, and before the rescuing party could reach him, his spirit took its

departure and fled to the Maker who gave it. At 2:30 a. m., July 4th, the lifeless form of Johnson was taken out of the mine. Had a false set been used, it is doubtful if any injury could have befallen him, and no one but himself and partner were interested in the mine.

Andrew Johnson was a native of Sweden, about 30 years of age, and had been a citizen of the United States 12 years.

KILLED AT THE ALTA.

On the evening of July 9th, Benjamin Temby and John Blight, two miners in the employ of the Helena and Livingston Smelting and Reduction Company, were working in the stope at the No. 7 tunnel of the Alta mine. They were getting ready to put in a set of timbers to support the hanging wall, but before they were ready to put up the timbers in their places the ground above them gave way, killing Benjamin Temby suddenly and seriously injuring John Blight. It was known that the ground above them was weak, and timbers had been put under the ground to support it, until the permanent timbers were secured, when suddenly the ground came off against a seam of soft clay in the hanging wall and rode the timber out of its place, causing at least 20 tons of rock to fall on the two men named. The company was entirely exonerated from blame, as death came absolutely accidental. Said Benjamin Temby was a native of Cornwall, England, and aged about 26 years.

KILLED AT ST. LAWRENCE.

On the 3d day of August an accident occurred at the St. Lawrence mine, where a man named William O'Rourke met his death. Mr. O'Rourke was a timberman in the St. Lawrence, and was cleaning up some dirt in order to stand up a set of timbers on the fourth floor above the 600 foot level. He was kneeling down cleaning some dirt out of the "tenant" of the lower set of timbers, and while in that position a small scale of ground caved down from above, causing instant death. Had he not been in a kneeling position at the time the rock fell, he would not have been injured. The accident was absolutely unavoidable, and all parties clear of all blame. He was about 28 years of age, and a native of Ireland.

KILLED AT ORO CACHE, MADISON COUNTY.

The following accidents have come under my notice without being notified officially of the matter: On September 28, 1889, a miner named Elias R. Jones was engaged to run a tunnel at the Oro Cache mine. "He had reached only 25 feet from

the surface, and only 6 feet of dirt above his head to the surface. "He had put up his tunnel sets and failed to brace them, and when the ground began to settle the timbers rode over, leaving the ground to fall on top of him." No one was near him at the time of the accident to know for certain how he came to his death, but I should presume that a jury would have been justified in rendering a decision that the deceased came to his death by carelessness in timbering, or else being an incompetent miner, not knowing how to secure the ground; and it looks to me anything else but an accident.

KILLED AT CLARK'S FRACTION, BUTTE.

Early in the summer an accident occurred in the Clark's Fraction mine. No one being present at the time of the accident, no satisfactory information could be gleaned. It appeared "that two Italians were at work at the bottom of the mine running a drift, when one had occasion to go back to the shaft to send up a car load of waste dirt. The engineer claimed that he gave the signal to hoist the cage, and when it had been raised a short distance the signal bell rang to stop the cage, and then two bells given to lower the cage back again; but when the man's comrade had reached the station he was found beneath the cage dead. For what purpose he went in the shaft under the cage is not known, and a doubt is entertained regarding the story of the engineer, although no other proof could be secured."

INJURED.

Never since the office of inspector of mines has been created has any mining superintendent notified us regarding serious accidents in their mines, except the Gangon Company. Whether it is on account of not knowing what the law demands, or carelessness on their part, I fail to prove.

INJURED AT LEXINGTON.

On the 27th of June, 1889, four men (contractors) were engaged in sinking the Lexington shaft. After blasting a round of holes they commenced to clean up the shaft, but some of the rocks were so large that they could not be placed in the car without breaking them up. To avoid breaking them, the car was taken off the cage and the rocks rolled on the cage. The men were compelled to assist in taking them off the cage at the surface. After the rocks were placed on the cage, Mike Sullivan and Jerry Holland got on top of the rocks to assist in taking them off the cage. When the cage was on its way to the sur-

face, by some means the rocks on the cage had shifted and got out under the wall plate of the shaft, which brought the cage to a sudden standstill, dashing the men against the "crossbars" of the cage. This happened when the cage was hoisted 550 feet from the bottom, and when the men fell upon the cage they were both knocked insensible; and with the shaft open below them, it seems almost a mystery that in falling on the cage they had not tumbled down the shaft and been killed. Such is an exceedingly dangerous practice, and I cannot imagine why such practices were permitted. Even if the rocks were sent up on the cage and the men remained at the bottom of the shaft, it would have been a dangerous system; for if a rock should fall off the cage and descend the shaft (as did one in this case, weighing it was supposed 50 pounds), an accident would probably occur.

After notifying the superintendent to put a stop to such matters, he notified the miners, who for a time paid some attention to it; but when the superintendent was slumbering in his bed, they would repair to the same system. Fortunately the superintendent stepped into the shaft house at 11 p. m. and discovered what was going on, and put an entire stop to all such work.

INJURED AT GRANITE MOUNTAIN.

On the 11th of July an accident occurred in the Granite Mountain mine, when Peter McGill was seriously injured. Mr. McGill and partner left their place of work for the purpose of going off the shift. They had reached a ladder way in the stope when McGill started to descend. His light went out just as he got upon the ladder. He then started to descend, and apparently slipped and fell to the bottom, a distance of about 75 feet.

No bones were broken, and McGill has no recollection of falling, and cannot tell how it happened. The greatest injuries sustained were bruises and suffering with concussion. It is surprising that after falling such a distance he had not been killed.

On the 5th day of August another man named Joseph Giles was descending a winze in a ladder, and fell out of the ladder. How it happened he cannot tell, but in his fall he had three broken ribs and some bruises.

INJURED AT GANGON.

An accident of a serious nature occurred at the Gangon mine on the 15th day of August. Thomas Sheers, whilst at work above the 800 foot level, left his partner and went down a

ladder way to get some powder to blast with. Returning to the stope, and while climbing up the ladder way, a rock weighing 15 or 20 pounds dropped out of the hanging wall and fell down, striking Sheers on the head, which knocked him down the ladder way to the 800 foot level, causing serious injury. He was taken to his home in an unconscious state, and remained so for several days, and his pains seemed almost too much to bear. Some time before this the ladder way was lagged at the place where the rock came from, but was removed by some one. The ground was considered perfectly safe even without the lagging, and after this small rock fell out the ground was so hard that it would require blasting to get out any more.

While investigating the above accident I was informed that a serious accident occurred in the same mine to a man named Walla by falling down a chute from the 500 foot level, a distance of 75 feet, causing such injuries that he had not resumed work up to the 15th day of August. No official notice was given of this accident.

INJURED AT MOOSE.

At 7 p. m. on the 23d day of August John Maynard and partner descended the Moose mine to the 200-foot station to commence working on the night shift. A few minutes later they entered the tunnel in which they regularly worked, and on reaching the face of the drift commenced to work, when suddenly a rock fell from the back of the drift and struck Maynard between the two shoulders, causing internal injuries. The men on the day shift had fired several holes on going off the shift and when Maynard and partner commenced to work it was their duty to look after the loose ground caused by the blast, but refusing to do so some ground fell and caused the accident.

INJURED AT WEST COLUSA.

On the 7th of September an accident occurred at the above named mine when A. J. Nichols was seriously injured by falling down a chute. He was standing over a chute taking out some lagging from a set of timbers above him. After several lagging was taken out a piece of ground caved down striking A. J. Nichols and knocked him down the chute, causing serious injuries. No one thought the ground to be dangerous and the accident was an unlooked-for occurrence.

BLASTED AT ANACONDA.

On the 10th of September a man named Farrel, a blaster in the Anaconda mine, loaded three holes—one a bottom hole and the other two top holes. He shot the lower hole first and

was going back to fire the other two when one of them went off injuring him so much that for some time it was thought that he could not recover. Both eyes were supposed to have been blown out, but it is hoped by eastern oculists that one eye can be saved. In matters of this kind where one hole depends on the other to break its burden, and the first hole exploded, a certain time should be allowed before going back where a fuse is in the others, and the different companies should make rules of their own relative to such matters, while on the other hand if the miners would only load the hole or holes necessary to explode at the first blast, no danger would exist of which they need be afraid when entering the place of the blast. Sometimes charges of powder are placed in holes and the fuse ignited but no explosion occurs, and I have seen men rush into the places of the missed holes almost as soon as they believed it to have missed fire, who have never returned alive while others are seriously hurt. In such cases I think no company ought to permit an employe to enter a place where a hole misses fire for at least three hours and that a report of such missed fire be reported to the shift boss, who can use precautions to prevent others from entering the place and a copy of such rules as they may adopt posted at the several stations in the mines so that the company's orders may not be forgotten or disobeyed. In case any one should be foolish enough to violate such rules that he be discharged.

INJURED AT ALICE.

On the 10th day of November an accident occurred at the Alice when Charles Lanier, an employe, received serious injuries which it is supposed resulted in death. He was working at the 1100 foot level in the shaft and while busily engaged a very small rock came down from above and struck him on the head. He was brought to the surface and walked to the company's hospital, a short distance from the mine. Little notice was taken of it at the time and after being idle ten days he resumed work. He worked about ten days and was taken with a violent pain in the head which compelled him to return home from work and in less than twenty-four hours his spirit took its flight and all that was left of the injured man was the corporal frame. Physicians claim that the skull was broken, while others denied it, but it is generally conceded that the effects brought about death. Where the rock come from no one knows.

DEATHS AT ANACONDA BY SUFFOCATION.

As reported before, the awful catastrophe at the Anaconda cannot be called an accident, where men volunteered to descend the burning mine for powder, and when one failed to come up

others followed to try and rescue their dead comrades. They were persuaded not to go, as no man could retain life for two minutes; but being actuated by feelings of love and respect for those whose lives were already sacrificed, deliberately walked into the arms of death, until the number of dead men amounted to six. No hopes were entertained of their recovery until the 6th of December, when it was thought the fire had been extinguished. At 7 o'clock on the morning of the 7th the shafts at Anaconda and St. Lawrence were uncovered, which showed no signs of smoke, and it was generally believed that the fire was at an end, and that the bodies would soon be recovered.

Shortly after the shafts were opened, a dog was sent down the Anaconda mine to the 800 foot level, and allowed to remain 10 minutes before being hauled to the surface. On reaching the 40 foot station it was heard to breathe once or twice, when it fell back dead. Thirty minutes later another dog was sent to the 500 foot level, and after remaining 10 minutes came up alive; but it was doubtful if he could recover; but after suffering much pain he got up and walked gently away. The general impression was that no fire existed in the mine, and orders were given to remove the bulkheads at the 600 foot level of the St. Lawrence mine. I left the mine at 6 p. m. on the 7th inst. with every hope of the bodies being recovered before the morning of the 8th, but on my return to the mine the condition changed, and the fire had broken out afresh, and the mine was again sealed and steam pumped into it from three sets of boilers. The sealing of the mine may cause the smoke and carbonic acid gas to suffocate the existing fire, but I am persuaded that the pumping of steam into the mine will not be of any benefit whatever, as the steam will most certainly condense itself into water long before reaching the fire, as the temperature of the mine cannot, according to the test made, be over 80 degrees. This may be surprising to many, but when there are probably hundreds of ways for air to get into the mine, it would naturally keep the mine cool, and condense the steam. When the fire first broke out, I suggested the propriety of pumping water into the 400 level and letting the water fall into the 500 foot level, where the fire occurred, which would saturate the dirt and timbers from the 400 foot level down, thus preventing the fire from spreading, or burning upwards to the 400 foot level. My next suggestion was the forcing of carbonic acid gas into the mine, which would exclude all air from the fire, and extinguish the entire burning. These suggestions were made, believing it to be to the best interest of all parties concerned; and although they may not meet with the approbation of the superintendent or any of the agents connected with the concern, time will prove that the injection of steam will prove valueless and useless, and if no

other method is adopted, the fire will never cease to burn until the last piece of timber is burned in the mine.

The entombed miners, Page, Kellerer, Dolan, Sullivan and Murphy, will probably be a long time in the mine before they can be taken out, and it is doubtful if all of their remains will ever be taken out. The bodies will never be recognized, especially the two who fell down the shaft a distance of 600 or 700 feet, and should they ever be taken out it will be hard to identify them, even by their apparel, and when they are presented to their friends for interment the question will be, who are they? This is about the greatest catastrophe that ever occurred in a Montana mine, and one long to be remembered by every resident of Butte, where nearly every household presented the appearance of mourning. Pat Lyons, the man rescued from the mine alive, was so seriously injured that after remaining the long period of two weeks between life and death was compelled to render up all that was mortal to join the immortal.

The number of stamp mills at work in Silver Bow county are as follows: Blue Bird 90 stamps, Lexington 60 stamps, Old Lexington 20 stamps, Alice 80 stamps, Moulton 40 stamps, Silver Bow (Butte and Boston) 50 stamps, making a total of 340 stamps, at work in Silver Bow county, capable of crushing 20,000 tons of ore each month, or 240,000 tons per annum.

The greatest amount of ore taken out of these mines is first quality, and is only put through the smelting and roasting process, while a large quantity is saved out and shipped to Omaha, New York, and even to Swansea for refinement, being too rich to be treated at the Butte smelters. Most of the ore shipped is taken from the Mountain View and Harris & Lloyd mines.

There are nine smelters in all at work in Silver Bow county, including Boston and Montana two, Silver Bow (Butte and Boston), Parrot, Butte Reduction Works, Colorado and Montana, Lexington, Alice, and Moulton. These smelters are capable of treating nearly 4,000 tons of ore per day, while the great smelters of Anaconda usually treat 2,500 tons each 24 hours, making a total capacity for handling nearly 7,000 tons of ore at the different mills and smelters each day. Some of the smelters are handling custom ores received from leasers and small mine owners, and it is generally considered that the Colorado and Montana smelter treats more custom ore than any other in Silver Bow county, it being capable of treating ores more successfully than any other.

The Parrot, Butte Reduction Works and Moulton also treat custom ores with great success. A large concentrator is connected with the Colorado works, also with Parrot and Boston

and Montana smelters. The Moulton, Parrot, and Butte Reduction Works have been closed for several months during the past year, and this has retarded the returns of these companies many thousands of dollars.

It is conceded that during the year 1889 no less than \$25,000,000 worth of ore has been taken out of the mines of Silver Bow county, although it is impossible to ascertain any accurate account from the different companies. Had not the mines and mills been closed down during the past year the output would have exceeded \$30,000,000, an amount which exceeds any county in the United States of America.

The different companies are represented by the ablest mining men that can be found in this or any other country. The Anaconda is under the entire control of the Hon. Marcus Daly. He came to Butte and first opened up the famous Alice and Magna Charta mines; then left the employ of the Walker Bros. to open up the great Anaconda. The mine was expected to be a large silver mine, but it was only sunk a small distance when it was found to be very rich in silver and copper. It is reckoned that the ore contains silver enough to make the mine pay without the copper, and this is considered to be the case with nearly every mine in Butte; so that all the copper produced is actually free to the companies outside of reduction. Mr. Daly's success in the Anaconda caused the opening of the St. Lawrence mine southeast of Anaconda. The mines are known all over the universe, and their directors are known as the leading men of the copper markets. Some time ago the group of mines north of the Anaconda were purchased from Mr. Chambers of Salt Lake, including the Mountain Consolidated, Green Mountain, Wake-up-Jim, High Ore, Belle, Modoc and Matte, which have been worked with the best success, employing at present 710 men underground, and around the shaft houses. This is the greatest group of mines in the world, and Mr. Daly's enterprises have all proved to be profitable. He came to America when young, and to-day is among the millionaires of Montana.

The property of the Boston and Montana Company is under the entire supervision of Thomas Couch, Esq. He was born at Cornwall, England. When a young man he engaged in mining on Lake Superior, then pushed his way to the Pacific Coast, working in the gold and silver mines of California. When the White Pine excitement occurred, Mr. Couch left California and successfully managed the greatest mine in White Pine county. After one year's labor in that county he went to Utah, where he spent several years, figuring prominently in the mines of that Territory. He came to Montana early in the

eighties, and has been doing good work ever since. He assisted in making the purchase of the property owned by the Boston and Montana Mining Companies, including Mountain View, Harris & Lloyd, East and West Colusas, Clark's Colusa, Liquidator, Shannon, Gambetta, and others, which is proving to be the richest property in Montana, as last year's report shows elsewhere. The miners of this State consider Mr. Couch's mining abilities unequaled in Montana, and everything he has undertaken to do so far in Montana, has proved a great success. He is considered as one of Montana's millionaires, and in addition to his mining duties he owns a large ranch in Cascade county estimated to be worth from \$40,000 to \$60,000; but it is doubtful if ever he can content himself outside of the mines.

The property of the Butte and Boston is under the management of C. H. Palmer. Mr. Palmer, assisted by several of Butte's prominent men, examined and reported on the several mines owned by A. J. Davies, which included a large group of mines. Soon after the report was placed in the hands of the company, a purchase was made for \$1,250,000; the principal mines being the Silver Bow, Gray Rock, East Gray Rock, Belle of Butte and La Platte. These mines soon commenced operations with intentions of finding out their real worth, and Mr. Palmer was engaged as the sole manager.

Mr. Palmer's career has been one of success, having worked successfully for mining companies in the copper mines of Michigan, and director of railroads in the same state. His work in Montana has also proved successful and it is anticipated that in a short time the mining operations of this company will more than equal any in the state. During the last election he was elected county commissioner for Silver Bow county on the Democratic ticket, and is proving himself a very efficient man in this direction.

The Parrot mine is worked under the direction of Benjamin Tibbey. He was born in Wales and began working underground when quite a youth. At the age of 14 he removed from Wales to the coal mines of Pennsylvania. When Butte City came into prominence as a mining country Mr. Tibbey moved to Butte, and commenced to work in the mines at miner's wages. It was soon discovered that he was capable of doing something more than slinging the hammer and drill and was soon engaged as superintendent of the Parrot mine which has been worked under his directions since 1881. The mine is developed to the 700 foot level and is a model mine for any camp on earth and produces an average of 260 tons of ore per day. Miners from every section of the civilized world admit it to be the best laid out

mine in the neighborhood. He also manages the Champion at Burlington. The ore of these mines are reduced at less cost per ton than any other in Montana.

Several of the Butte mines are under the management of the Hon. W. A. Clark, who is supposed to be the richest man in Silver Bow county, but although worth from \$3,000,000 to \$3,500,000 he dons the miners' garb and descends the mines to see that they are satisfactorily developed. He owns "seven-eighths" of the Moulton but has engaged the Hon. J. K. Clark (a democratic member of the present legislature from Silver Bow county) as superintendent of this mine and mill who is a well known mining man.

W. E. Hall has control of the Alice, Magna Chartar, Valdemere, Blue Wing and several other mines in Butte owned by the Walker Bros., of Salt Lake City. He took charge of these mines in 1880 and has served this company continuously since, except a few months during the summer of 1888, when the mines closed down on account of some trouble with the Utah & Northern Railroad. He has worked and managed mines in nearly every state in the Union and has had great experience in mining. He held the office of county commissioner as a Republican and refused a re-nomination on the territory becoming a state.

The men mentioned have not opened these mines with the mere theory of mining acquired while studying at some school of mines or at the hands of some one else, but they have each of them been brought up in the midst of mining and they have gathered their mining knowledge by working in the largest mines of the known world and to-day their mines are worked upon the greatest improved system of mining, having improved on the work formerly adopted in the mines in which they themselves have worked.

Men from all over the United States are coming to Butte, and their opinions are unanimous in saying that they have never seen mining carried out as extensively as it is at Butte.

A few years hence the capacity of mines, mill, concentrators and smelters, will without doubt be doubled, and Butte will not fail to become the railroad and mining center of the great state.

The Gangon is under the management of Chas. W. Goodale as is also the Nettie and all other mines belonging to the Colorado Mining Smelting & Reduction Company. He came to Montana and took charge of the mines of the company and it is estimated that the company at present pays about \$125,000 per annum in dividends. Mr. Goodale is a popular young man, and figures prominently in politics. He has been elected councilman

for Butte City, and during the last election he was nominated by the Republican party of Silver Bow county for state senator, and if elected, would have made a good mining advocate. He was, however, defeated by D. J. Hennessey, a dry goods merchant of Butte, the same man who was defeated by Mr. Goodale for the council.

The number of concentrators at work crushing the ore taken from the Wickes mines is two. The Corbin concentrator is reckoned to be the largest in Montana, "and by working it twelve hours each day can easily concentrate 250 tons" of the Alta ore, which contains gold, silver and lead. The concentrates are then shipped to the East Helena smelter, but it is rumored that the Wickes smelter will soon commence to smelt the ores taken out of the mines of the H. M. & R. Company.

The Comet concentrator is not as large as that at Corbin, and only capable of crushing about 100 tons daily; but for several months the daily output has not amounted to over 60 tons. Several years ago it was thought that the Comet would make a prosperous mining camp for many years, but instead of the mines opening up as was expected in 1885, they began to recede in value, and many families were compelled to move out. Several changes have taken place in the officers of the company during the past few years. Mr. Longmaid took charge of the smelters at Wickes, and concentrators at Corbin and Comet, in 1883, and was relieved in February, 1885, by Prof. Raht. The professor is a native of Germany, and has been connected with mining in Germany and America for a long period; his principal practice being that of mills, concentrators and smelters. Prior to his coming to Montana he was engaged in some of the principal mines in Utah, where his labors were crowned with success. In 1883-84 he was in charge of the mines and mills of the Gregory, but before much work was done after the new hoist and mill were completed he took charge of the entire plant connected with the H. M. & R. Company. The mines were attended to by the assistant superintendent, J. R. Gilbert. Mr. Gilbert is a native of Penzance, England, and for many years worked in the greatest tin mines of Cornwall. When quite a young man he emigrated to California, where he worked for several years, most of his time being spent in Nevada City and Grass Valley. About nineteen years ago he came to Montana, and soon took charge of some mines at Radersburg, where he remained for eight years. In 1882 he went to the Island, about fifty miles from Butte, as foreman of some mines, and in the fall of the same year he was in charge of the Shakespeare at Butte, under John Longmaid. Early in 1883 he took charge of the Gangon, under Col. Thornton, and in November of 1883 he removed to Wickes, where he has remained ever since, and his

services to the company have been invaluable. No man in Montana has a better reputation as a mining man, and every miner in his employ speaks highly of him. He is as affable to the miner as he is to the greatest millicnaire (a feature not generally observed), which assists to elevate him in the estimation of all mining men. He has several ranches in Beaverhead county, and a large band of cattle and horses.

Many of our very prominent mines are lacking the amount of ventilation desired by the miners themselves, and several times during the past summer I am informed that several men have been brought out of the mines in the immediate neighborhood of Butte almost suffocated for want of air to force out the gases produced by the giant powder; but so long as no person has met death by such foul air, no other methods will be adopted to improve the condition of the poor air places; while several men were compelled to give up their employment because it was too injurious to endure. Several other mines are void of proper egress, and will probably fail to bring about a certain means of escape until the law compels it, or a very great disaster occurs.

Another very important thing in connection with our mines is the sinking of shafts without lining them. Three of those men now in the depths of the Anaconda mine would probably have come to the surface alive, if the shafts were lined or cased, while no less than two men have been injured in one shaft in less than two weeks by the cage. Surely some method can be adopted to prevent men from falling off a cage in going down or coming up a shaft. Nine men are generally allowed on a single decked cage at the same time, and the bottom of the cage is not generally more than 3 feet 6 inches by 4 feet, and when nine men are placed upon it, it is generally well filled, and when men are raised and lowered at the rate of 1,000 feet per minute, they most certainly need something more than the crossbar of a cage to support themselves with, as the crossbar is generally two feet higher than mens' heads. True the lining of shafts may be somewhat expensive, but many of our prominent mining men say that all companies should be compelled to adopt the system of lining the shafts. Others think that the dangers would be as great or greater if the shafts were lined, but such argument seems to be without any reasonable basis. It may happen that a plank will spring out of its place, but the dangers are a hundred times greater in shafts not lined, than in shafts boarded from top to bottom. To sink a three compartment 1,000 feet deep it would require about 64,000 feet of one-inch plank to line the entire shaft from top to bottom, with a probable expenditure of \$9,600, but this would not be a sudden outlay, and would not average to any

company over \$1,000 per annum. Ten years have elapsed since any of our deep mines were first opened, and it is doubtful if the average sinking of our mines is anything over a hundred feet each year; this would require about 5,800 feet of timber each year and would bring about very much safety for the men who have to encounter so many dangers in the mines.

Several mines in Montana are worked from an incline shaft varying from fifteen to twenty degrees from vertical in which buckets are used for hoisting and lowering men, and my opinion is that the day has arrived that no incline ought to be sunk to a very great depth, with a bucket rolling from one side to the other with men in it, when there are so many improved systems that can be adopted with very little cost. Where an incline does not change its grade an adjustable cage can be used with every modern improvement, in safetys, bonnets, etc., and where an incline changes its degrees, then a self-dumping skip can be used as successfully with safety appliances, etc., as with an adjustable cage.

The dangers of riding on a bucket are much greater than on a cage without any safety appliances, but our legislators in the past have seen fit to enforce the use of certain safety appliances to cages, and now some steps should be taken to remove the buckets from those incline shafts below a reasonable depth, so that the dangers now existing to life and limb should be lessened as far as possible.

Many accidents happen through the explosion of blasts, and most of them from blasts which fail to explode at the proper time, and men rush back to reload them too early. No man ought to go near a "missed hole" for at least three hours, and it is to the interest of the company and employe to adopt such a rule; although miners themselves are too careless in regard to such matters, and rush back to such holes without giving anything more than an ordinary amount of time for the powder to explode.

In several mines one thing is practiced with powder that is very dangerous, viz.; when the miner goes to his labor in the morning, or at night, he first repairs to the box containing giant powder and places from one to six sticks of powder in his boot legs, and said powder is kept there until soft enough to explode. During the day the men are at work and it is a wonder why men are not blown to atoms from concussions while at work. Others will wait till they are ready to blast their holes and then take the hard, frozen giant powder and thaw it out over a burning candle. Some will say that men who will do such work, are maniacs, but when the company under which they work, have no magazine, heated at a temperature capable of softening the giant powder, and will not permit them to "waste" time in order to get ready for blast-

ing it means to adopt the dangerous method or quit the company's employment. When steam pumps are used in a mine, a very small piece of cost would prevent such dangers, and if no steam was used, the cost of adopting a method would not be realized, and an amount of danger done away with that is not equalled in mining.

Another danger so oftentimes practiced in mines is the riding up a shaft with full cars of dirt, and one would suppose no mining company would permit such practices, for when cages are loaded with car loads of ore or waste no man ought to be permitted to ride, but such is being done in several large mines in Montana and should a man, or men, be deprived of life from this method, then the mine owners or superintendents will see the propriety of abandoning the practice.

During my official examination at Butte and neighborhood many inquiries were made regarding the benefits of the Mining Inspector bill.

I do not think a better or more needed bill was ever placed upon the Statutes of Montana.

True, every nerve was stretched and every possible means used to kill the bill before the Legislature of 1888, and several prominent superintendents were called upon to render their decisions on the questions, which were anything but favorable. They were looking to the interests of the mining companies, for if the Inspector only had the power given him by the law as he should have, they well know that some expensive outlay would have to be made, to make things what they should have been.

No superintendent whose mine is worked safely, would feel grieved by allowing an Inspector to descend the mine, but on the other hand should be pleased to show him through, so that if every precaution was not used for the safety of mens lives, it could be done by force.

If the voice of the employes was heard upon the same question from many mines it would be more strong in favor of the bill than any superintendent could be against it. The expressions of the bill is by no means strong enough and unless absolute danger exists in a mine many superintendents will run chances of an accident rather than obey the orders of an officer in this sphere of labor. A company may run a drift one thousand feet from the shaft with no air except compressed air which escapes from a drilling machine. Men with families are placed here to work and many are brought to the surface insensible, (owing to the poor air) and all that can be done according to the law is to instruct the agent to secure better ventilation and

trust to their generous hearts to get the work done. If no one is suffocated to death by the poor air and die suddenly by being overcome with the gases, then are they free from the law, and yet it is daily bringing men to a premature grave.

Supposing the employes were to enter a complaint to the agents, what would be the answer? If you do not to work there, your time is at the office. A case of that kind came under my notice in the year 1887, and this is only one case in hundreds. Fourteen men were engaged in a stope about 700 feet from the mouth of the tunnel who could not do half labor while on duty. When they were ready to walk out of the tunnel they were compelled to support themselves by holding fast of the tunnel sets in coming out of the mine. Week after week the ~~agent~~ ^{agendition} of affairs went on until the men held a consultation in the mine at 9:30 a. m. They concluded to invite managers to make connections to the level above or else ^{all} every man in the tunnel to give them ventilation. When the ^{agent} ^{as} plainly stated the reply was, "any man who does not stand it off can get his check right now." Eleven of the fourteen accepted the agents proposition and took ^{all} ^{the} com_{me} checks, while the other three was poor and with families ^{ely to} almost compelled to return to the pit of gas, unfit for any ^{le,} man being. Had the Inspector of mines directed improvements in this direction it would be a matter of judgment on the part of the agent, for the results would not be apt to prove fatal to any men except to ruin their health, and after years of sickness pine away and die.

There are also many of our mines worked by a single shaft which only affords one means of escape. If the miners should descend the mine and something happened to the works above, so as to destroy the machinery and burn up the shaft house, what would be the result? The probabilities are that every man beneath the surface would be suffocated to death. Shaft houses seldom burn, it is true; but such things have happened, and not long since. In the neighborhood of Butte an entire plant was consumed while the men were beneath the surface, but fortunately a means of escape was in the mine, which required immediate action on the part of the men, numbering twenty. The cry, "Escape for thy life!" was raised from one end of the mine to the other, and men fled with all speed to prevent suffocation. Had there been no means of escape, twenty men would have been taken out dead; and then the sorrowful tale would have been told where homes were deprived of their comforts, and widows and orphans allowed to get through life as best they could.

Another system so often used in our mines is the use of what is known as the crosshead, instead of a cage. Several

men have met their death by the use of such a system as this. Some of our mines that are rich, and as a matter of fact are expected to work at least a quarter of a century, still cling to this old-fashioned system. I claim that such a method as this is a thing of the past, and not equal to modern improvements. Imagine eight men descending a shaft $4\frac{1}{2}$ feet by $3\frac{1}{2}$ in size, riding on a piece of wood only 6 or 8 inches in width, holding fast to the cable for support. On either side of the men is a space of fully two feet, and should a man become dizzy or nervous and fall, or should a jar of the rope cause men to be shaken, what would be the result? These old-fashioned traps have not any safety appliances or bonnets, and were the cable to break with a crowd of men on, the disaster would be awful, and would be realized to its full extent when the mangled and unrecognizing frames would be brought to the surface.

It is my opinion in some cases that in commencing a mine the lessor tries to put up machinery large enough to fill a cage; and such matters should have a line drawn, and a inspector allowed to use his discretion in the matter, although of Moxtre cost in putting up machinery large enough to use a cage would not be much more than other machinery.

It is often claimed that the \$5,100 paid out of the State fund is a waste of capital, but while such argument has been laid before the public by those who once knew the same requirements of the inspector's bill, ten thousand miners are urging our legislators to place measures upon our statutes more strong than the measures of the present bill, and if any men in Montana have a right to be represented in our legislative halls it is those who descend into our mines, and whose dangers are greater and more numerous than any others in the State.

Every industry in Montana depends materially upon mining, and the number of men employed in this capacity exceeds any other two. When the miners of Montana at large urged the passage of the inspector's bill, it was not to secure some one a position at \$2,500 a year, nor to drain the State treasury of its capital; but they knew their lives to be exposed to unnecessary dangers, which the agents of mines would not remedy.

Nearly every county in Montana is represented by its mining industries, and are acknowledged to be mining counties, and the miner is less represented in our legislative chambers than any other industry in Montana. When the squirrel bounty bill was enacted it was to protect the wealth of the farmer, and \$20,000 was spent in a short time, which would soon have drained the funds of the treasury; but when the mining inspector's bill was enacted

it was with a view to protect human life, and lessen the awful disasters in the mines to the employes; and if the measures are carried out by practical men who understand their duty, it would prevent many a poor man from going to a premature grave, and no legislator with any feeling of human nature would hesitate to enact any law which would have a tendency to lessen the list of accidents.

Seeing that our superintendents are somewhat careless in notifying the inspector or his deputy of the serious accidents in their mines, the inspector's bill should provide that the inspector or deputy make complaint to the attorney general of such negligence, and inflict the fine as provided by law, for if the law cannot be enforced it would be valueless and the mining agents become careless regarding the bill.

It would most certainly be an injustice to every miner in Montana to repeal a single measure in the bill, and it would only be justice to the miner, and honorable on the part of our legislators to add to the bill many more measures which wou'd give the inspector or his deputy power to compel all companies to remedy any and all dangers which would be likely to cause accidents to any miner, thereby *lessening*, if possible, the disasters in our mines to its employes.

I have the honor to remain your obedient servant,

J. B. TREVARTHEN,

Deputy Mining Inspector.

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